

My analysis construes the other terms of this element in accordance with their ordinary and customary meaning to one of ordinary skill in the art during the time frame of October 1995.

**Claim 40, element d - analysis by Dr. Cook of the Gorog '028 Patent**

Dr. Cook's analysis of this element is as follows:

Reexamination col. 2 lines 18-23: "means for transmitting at least the first data and the payment authorization information to a product/service provider in accordance with the first data, in response to receipt by the central data processor of an order confirmation message from the remote terminal"

**Claim 40, element d - my analysis of the Gorog '028 Patent**

The Gorog '028 Patent does not perform this Claim element: "Link the inferred event with an action to be performed during the sales process based on prior sales experience using the sales system,"

The Gorog '028 Patent does not describe events or an event management system – see Claim 1 b. The Gorog '028 Patent does not describe linking of events to actions. The patent does not disclose "an action to be performed during the sales process based on prior sales experience using the sales system".

**Claim 40, element e - language**

- "Automatically initiate an operation using one or more of the plurality of subsystems to facilitate the action to be performed based on the inferred context."

**Claim 40, element e - construction**

- "Context" - "information already existing within the system that becomes relevant upon the occurrence of an event";
- "Inferring" - "logical process by which a factual conclusion is derived from known facts by the application of logical rules";
- "Inferring . . . a context in which the event occurred" - "logical process by which the fact that information already existing within the system that becomes relevant upon the occurrence of an event is derived by application of logical rules";

- “Subsystem” - “a system that is part of a larger system”;

My analysis construes the other terms of this element in accordance with their ordinary and customary meaning to one of ordinary skill in the art during the time frame of October 1995.

**Claim 40, element e - analysis by Dr. Cook of the Gorog ‘028 Patent**

Dr. Cook’s analysis of this element is as follows:

Reexamination col. 2 lines 18-23: “means for transmitting at least the first data and the payment authorization information to a product/service provider in accordance with the first data, in response to receipt by the central data processor of an order confirmation message from the remote terminal”

**Claim 40, element e - my analysis of the Gorog ‘028 Patent**

My analysis of this element is the same as my analysis for Claim 1, element d.

***VI.G EXPERT SYSTEMS AND SALES STRATEGIES BY STONE & GOOD (THE  
“STONE REFERENCE”)***

**VI.G General Overview of the Stone Reference**

**The Stone Reference**

- R. Stone and D. Good, "Expert Systems and Sales Strategies," *Proceedings of the 1990 ACM SIGBDP Conference on Trends and Directions in Expert Systems*, Orlando, Florida, 1990, pp. 52-57, , available from Association of Computer Machinery 089791-416-3/90/0010/0052 [note: SIGBDP = Special Interest Group on Business Data Processing]

**Claims at Issue**

The Cook Report states that “Stone, Robert W. & Good, David J.: Expert Systems and Sales Strategies, Association of Computer Machinery 089791-416-3, 1990 anticipates asserted Claims 1-3, 5-8, 10, 12, 20, 24, 34, 35, 37 and 40.” (Cook Report, p294)

**Dr. Cook’s Summary of the Stone Reference (quoted from his Expert Report)**

"170. The Stone publication describes an application of artificial intelligence (c.g., expert systems) to a process occurring along a business value chain (e.g., marketing and sales organizations). The application teaches the implementation of an expert system into the computerized reservation system of a Resort Hotel. The event manager is the processor of the computer reservation system. Subsystems coupled to the event manager are the expert system and peripheral computer system components.

"171. Databases of the system consist of all the hotel's guest records for each guest's stay during the past years. The system relies on three factors. First, the continual updated history on each guest and the guest's stay in the hotel. Second, a complete listing of each room in the hotel and the characteristics of the room. Finally, a listing of the management's operation and sales strategies for the hotel. This information provides contexts for the present system.

"172. When a returning guest calls the hotel, to inquire about vacation opportunities or to make a reservation, the system detects a change in state. The reservationist enters the individual's name into the reservation system. Using the guest's name, the system produces a display containing the guest's previous stays, if any, and their preferences with respect to room characteristics, from past records. The event inferred, through a logical process using rules, is whether the guest is a past guest, and/or that the guest is interested in making a reservation. Upon the inferred occurrence, certain contextual information

(described above) is derived as relevant based at least in part on the detected change in state.

"173. The reservationist then switches to a second display that is a form to enter the guest's present needs or interests. Given the information regarding previous stays and current room preferences and each room's characteristics, the expert system is automatically triggered to suggest available rooms during the proposed stay of the guest. These suggestions are rooms which best fit the inferred contexts, i.e., the guest's preferences and needs, while satisfying the hotel's management and sales strategies. The expert system operation facilitates the action of presenting the suggestion(s) to the caller."

### **My Summary of the Stone Reference**

The Stone reference considers the use of expert systems in sales and marketing organizations. The authors report that "the use of expert systems in marketing and sales has been limited."

The paper briefly describes three expert systems applications developed by different firms as part of their sales strategy. The first example was a resort hotel's reservation expert system that took customer past stays, preferences and needs into account to suggest available rooms, resulting in reduced reservationist training and increased daily profits. A second example briefly describes that Citicorp implemented an expert system to help sales representatives match products to customers. A third example is an expert system from Texas Instruments that helps prospective customers identify their needs for an expert system from TI's product line.

The paper's *Concluding Remarks and Future Research Directions* section states "It appears that sales strategies and the sales management function have just seen the beginning of expert systems use." [Stone, p56]

### **Dr. Cook's Analysis of the Stone Reference from his Expert Report pp. 37-38 (quoted)**

169. I considered and analyzed Stone, Robert W. & Good, David J. Expert Systems and Sales Strategies ("the Stone publication"). The Stone publication was "known or used by others" in the United States prior to the October 30, 1994 critical date for the '525 Patent.

170. The Stone publication describes an application of artificial intelligence (e.g., expert systems) to a process occurring along a business value chain (e.g., marketing and sales organizations). The application teaches the implementation of an expert system into the computerized reservation system of a Resort Hotel. The event manager is the processor of the computer reservation system. Subsystems coupled to the event manager are the expert system and peripheral computer system components.

171. Databases of the system consist of all the hotel's guest records for each guest's stay during the past years. The system relies on three factors. First, the continual updated history on each guest and the guest's stay in the hotel. Second, a complete listing of each room in the hotel and the characteristics of the room. Finally, a listing of the management's operation and sales strategies for the hotel. This information provides contexts for the present system.

172. When a returning guest calls the hotel, to inquire about vacation opportunities or to make a reservation, the system detects a change in state. The reservationist enters the individual's name into the reservation system. Using the guest's name, the system produces a display containing the guest's previous stays, if any, and their preferences with respect to room characteristics, from past records. The event inferred, through a logical process using rules, is whether the guest is a past guest, and/or that the guest is interested in making a reservation. Upon the inferred occurrence, certain contextual information (described above) is derived as relevant based at least in part on the detected change in state.

173. The reservationist then switches to a second display that is a form to enter the guest's present needs or interests. Given the information regarding previous stays and current room preferences and each room's characteristics, the expert system is automatically triggered to suggest available rooms during the proposed stay of the guest. These suggestions are rooms which best fit the inferred contexts, i.e., the guest's preferences and needs, while satisfying the hotel's management and sales strategies. The expert system operation facilitates the action of presenting the suggestion(s) to the caller.

174. The foregoing description is by way of example only and is intended to illustrate, in general terms, the functionality of the described system to provide context. As I discuss in the Claim chart, it is my opinion that under the Court's constructions, the asserted Claims 1-3, 5-8, 10, 12, 20, 24, 34, 35, 37 and 40 of the '525 Patent are anticipated by the Stone publication under 35 U.S.C. § 102 (a) and (b). It is also my opinion that the remaining asserted Claims are obvious in view of the Stone publication, either alone or in combination with other references herein.

175. A detailed analysis of how this reference anticipates and/or renders obvious the asserted Claims of the '525 Patent is provided in Appendix C, pages 294-322.

### Relevance of the Stone Reference to the '525 Patent

The Stone reference is very short (6 pages) and provides few technical details on the expert systems or sales applications surveyed. The three expert systems described in the paper are single task sales tools and do not provide a sales force automation system consisting of a system of subsystems. The terms *event*, *rule*, *inference*, and *context* are not used nor does the paper itself describe a system or framework for connecting together sales systems based on expert systems, rules, events, or inference. The paper indicates in its conclusion that considerable future work will be needed to realize potential benefit to the sales and marketing value chain.

Cook argues that the reservation expert system consists of separate subsystems

“The event manager is the processor of the computer reservation system. Subsystems coupled to the event manager are the expert system and peripheral computer system components. Databases of the system consist of all the hotel's guest records for each guest's stay during the past years. ... The expert system operation facilitates the action of presenting the suggestion(s) to the caller.” [Cook, paragraph 170-171, 173]

but the Stone reference does not provide a system architecture showing subsystems; instead it refers to the reservation system and the expert system synonymously and to the “expert system’s database” (which may be part of the expert system).

The Stone reference does not describe whether “a logical process using rules” is used when looking up information related to guests. The Stone reference does not explain how the system is triggered to combine the current guest, their previous stays and preferences and the hotel sales strategies. From the description in the paper, the reservation expert system does not share its information with other subcomponents of the sales force automation system, nor does the reader learn the architecture of the system or whether it uses inference, context, rules, or other mechanisms. The description is too high level to make a determination.

In addition, the Stone reference is similar to, and hence cumulative to, much of the prior art that was before the examiner during the prosecution of the '525 Patent. For example, the Stone reference is cumulative to the following systems which, I understand, were developed by the assignee of the '525 Patent – Clear with Computers: (i) the ISIS System, which was of record during the prosecution of the '525 Patent; and (ii) the Truck Force Tools System which was of record during the prosecution of the '525 Patent. In addition, the Stone reference is cumulative to a number of the United States Patents that were considered by the examiner during the prosecution of the '525 Patent.

#### **VI.G. Claim 1 in view of the Stone Reference**

##### **Claim 1, preamble - language**

- "A computer implemented sales system used to facilitate a sales process, the system comprising:"

##### **Claim 1, preamble - construction**

The Court has not construed this preamble. My analysis construes the terms of this preamble in accordance with their ordinary and customary meaning to one of ordinary skill in the art during the time frame of October 1995.

##### **Claim 1, preamble - analysis by Dr. Cook of the Stone Reference**

Dr. Cook's analysis of this preamble is as follows:

The preamble is not a limitation.

"The rapid growth of artificial intelligence, and more specifically expert systems, in business has generated a need for investigations concerning computer based intelligence systems within all facets of a business organization." (Introduction, p.52)

"The focus of this paper is the application of one type of information technology (expert systems) to one point along the business value chain (marketing and sales)." (The Theoretical Framework, p. 54)

"The expert system provides a comprehensive method to alter marketing and sales strategies (e.g., adjust room rates or promote special packages). In the past, manual systems had no such comprehensive method. Using the expert system, any adjustments in strategy can quickly and comprehensively be made by altering the appropriate parameters in the expert system." (Expert Systems and Sales Strategies, p. 55)

**Claim 1, preamble - my analysis of the Stone Reference**

The Court has not construed this preamble. The '525 Patent title is "Integrated Computerized Sales Force Automation System" and at the very beginning of the Specification (in the section *Background of the Invention*), the inventors describe problem their invention solved:

"The present invention is directed to a sales force automation system and, more particularly, to an automated sales system which facilitates the sale of an item or service by intelligently integrating into a single system tools used by a salesperson in the sales process." ['525 Patent, 1:5-9]

"Most conventional sales systems have been implemented in a limited manner and are typically directed solely to a particular event, task or small subset of tasks in the sales process. Such systems are constructed by examining a particular sales event and by developing an automated tool to assist the salesperson confronted by the particular event. Such systems are individually developed without regard for other events occurring in the overall sales process in which the salesperson is engaged. As a result, conventional systems fail to provide full support for the salesperson." ['525 Patent, 1:10-19]

The Stone reference describes three such sales tools that individually implement one step in a sales process, are not integrated in that they do not connect to each other, and do not provide the salesperson full support. The Stone reference is brief and provides little written description of how the three sales tools operated.

**Claim 1, element a - language**

- "a plurality of subsystems configured to facilitate one or more actions performed during at least one phase of the sales process; and"



**Claim 1, element a - construction**

- “Subsystem” - “a system that is part of a larger system”;

My analysis construes the other terms of this element in accordance with their ordinary and customary meaning to one of ordinary skill in the art during the time frame of October 1995.

**Claim 1, element a - analysis by Dr. Cook of the Stone Reference**

Dr. Cook’s analysis of this element is as follows:

“The focus of this paper is the application of one type of information technology (expert systems) to one point along the business value chain (marketing and sales).” (The Theoretical Framework, p. 54)

“The expert system provides a comprehensive method to alter marketing and sales strategies (e.g., adjust room rates or promote special packages). In the past, manual systems had no such comprehensive method. Using the expert system, any adjustments in strategy can quickly and comprehensively be made by altering the appropriate parameters in the expert system.” (Expert Systems and Sales Strategies, p. 55)

**Claim 1, element a - my analysis of the Stone Reference**

This Claim element does not mention “expert systems” that are the subject of the Stone Reference. Dr. Cook’s analysis (above) does not described how expert systems are related to “a plurality of subsystems ... in a sales process.”

The statement “The expert system provides a comprehensive method to alter marketing and sales strategies” that Dr. Cook quotes is just an assertion by the authors of the Stone Reference, without further justification.

**Claim 1, element b - language**

- “an event manager, coupled to the subsystems, the event manager detecting one or more changes in state characteristic of an event occurring within the system,”

**Claim 1, element b - construction**

- “Subsystem” - “a system that is part of a larger system”;

- “Event manager” - “hardware and/or software”;
- “Changes in state characteristic of an event” - “a change in a unique configuration of information within the system that is indicative of the occurrence of an event within the system”;

My analysis construes the other terms of this element in accordance with their ordinary and customary meaning to one of ordinary skill in the art during the time frame of October 1995.

**Claim 1, element b - analysis by Dr. Cook of the Stone Reference**

Dr. Cook’s analysis of this element is as follows:

Pages 54-55. When a returning guest calls the hotel to make a reservation, the reservationist enters the individual's name into the reservation system. Using the guest's name, the system produces a display containing the guest's previous stays and their preferences with respect to room characteristics. The reservationist then switches to a second 54 display which is a form to enter the guest's needs. Given the information regarding previous stays and current room preferences and each room's characteristics, the expert system suggests available rooms during the proposed stay of the guest. These suggestions are rooms which best fit the guest's preferences and needs while satisfying the hotel's management and sales strategies. Primary among these sales strategies is to minimize short term (one night) room vacancies.

The system relies on three factors. First, the continual updated history on each guest and guest stay in the hotel. Second, a complete listing of each room in the hotel and the characteristics of the room. Finally, a listing of the management's operation strategies for the hotel. Among these operation strategies is management's sales strategy for the hotel.

**Claim 1, element b - my analysis of the Stone Reference**

Dr. Cook does not identify whether the reservation system had an “event manager” or how such an event manager operated, nor does the Cook reference. The reservation expert system of the Stone Reference appears to be a standalone system.

**Claim 1, element c - language**

- “Inferring occurrence of the event and a context in which the event occurred based at least in part on the detected changes in state, and”

**Claim 1, element c - construction**

- “Context” - “information already existing within the system that becomes relevant upon the occurrence of an event”;
- “Inferring” - “logical process by which a factual conclusion is derived from known facts by the application of logical rules”;
- “Inferring . . . a context in which the event occurred” - “logical process by which the fact that information already existing within the system that becomes relevant upon the occurrence of an event is derived by application of logical rules”;
- “Inferring occurrence of an event” - “logical process by which the fact that an event has occurred is derived by application of logical rules”;

My analysis construes the other terms of this element in accordance with their ordinary and customary meaning to one of ordinary skill in the art during the time frame of October 1995.Claim 1, element c - analysis by Dr. Cook of the Stone Reference

**Claim 1, element c - analysis by Dr. Cook of the Stone Reference**

Dr. Cook’s analysis of this element is as follows:

“Using the guest’s name, the system produces a display containing the guest’s previous stays and their preferences with respect to room characteristics. The reservationist then switches to a second display which is a form to enter the guest’s needs. Given the information regarding previous stays and current room preferences and each room’s characteristics, the expert system suggests available rooms during the proposed stay of the guest.” (Expert Systems and Sales Strategies, p. 54-55)

**Claim 1, element c - my analysis of the Stone Reference**

Dr. Cook reports a description of some steps taken by the reservation system in the Stone reference. In my opinion, the steps Dr. Cook describes in the quotation from p 54-55 are not in response to subsystem-level events, but the Stone reference does not provide enough information to be sure. From the description, it appears the reservation expert system is a standalone system, not a mechanism used to integrate subcomponents.

**Claim 1, element d - language**

- “automatically initiating an operation in one or more particular subsystems of the computer to facilitate a new action based on the inferred context.”

**Claim 1, element d - construction**

- “Context” - “information already existing within the system that becomes relevant upon the occurrence of an event”;
- “Subsystem” - “a system that is part of a larger system”;
- “Inferring” - “logical process by which a factual conclusion is derived from known facts by the application of logical rules”;
- “Inferring . . . a context in which the event occurred” - “logical process by which the fact that information already existing within the system that becomes relevant upon the occurrence of an event is derived by application of logical rules”;

My analysis construes the other terms of this element in accordance with their ordinary and customary meaning to one of ordinary skill in the art during the time frame of October 1995.

**Claim 1, element d - analysis by Dr. Cook of the Stone Reference**

Dr. Cook’s analysis of this element is as follows:

“Given the information regarding previous stays and current room preferences and each room’s characteristics, the expert system suggests available rooms during the proposed stay of the guest. These suggestions are rooms which best fit the guest’s preferences and needs while satisfying the hotel’s management and sales strategies.” (Expert Systems and Sales Strategies, p. 55)

**Claim 1, element d - my analysis of the Stone Reference**

The Stone Reference does not meet this Claim element: “automatically initiating an operation in one or more particular subsystems of the computer to facilitate a new action based on the inferred context.” It is difficult to see from the brief description in the Stone reference whether the expert system’s operation is automatically initiated.

**VI.G. Claim 2 in view of the Stone Reference**

**Claim 2 - language**

- "[A system as recited in claim 1,] wherein the inferred context includes information related to at least one phase of the sales process."

**Claim 2 - construction**

- "context" - "information already existing within the system that becomes relevant upon the occurrence of an event";
- "inferring" - "logical process by which a factual conclusion is derived from known facts by the application of logical rules";
- "inferring . . . a context in which the event occurred" - "logical process by which the fact that information already existing within the system that becomes relevant upon the occurrence of an event is derived by application of logical rules";

My analysis construes the other terms of this element in accordance with their ordinary and customary meaning to one of ordinary skill in the art during the time frame of October 1995.

**Claim 2 - analysis by Dr. Cook of the Stone Reference**

Dr. Cook's analysis of this element is as follows:

[Claim 1 chart incorporated by reference]

"Using the guest's name, the system produces a display containing the guest's previous stays and their preferences with respect to room characteristics. The reservationist then switches to a second display which is a form to enter the guest's needs. Given the information regarding previous stays and current room preferences and each room's characteristics, the expert system suggests available rooms during the proposed stay of the guest." (Expert Systems and Sales Strategies, p. 54-55)

**Claim 2 - my analysis of the Stone Reference**

See claim elements missing from Claim 1.

The Stone Reference does not perform this claim element: "wherein the inferred context includes information related to at least one phase of the sales process."

Among other things, whereas it can be said that the Stone Reference does contain “context” [“information already existing within the system that becomes relevant upon the occurrence of an event”] includes “information related to at least one phase of the sales process” insofar as the system uses information sources including “previous stays” and “room preferences,” the Stone Reference does not describe that the context was inferred using a “logical process by which a factual conclusion is derived from known facts by the application of logical rules”. The Stone Reference does not describe an event manager that “detect[s] . . . infer[s] . . . and automatically initiat[es] an operation” as required by Claim 1 or that any inference step that is part of an event takes place.

#### **VI.G. Claim 3 in view of the Stone Reference**

##### **Claim 3 - language**

- “[A system as recited in claim 1,] wherein the inferred context includes information related to whether a previous event has occurred in the sales process.

##### **Claim 3 - construction**

- “context” - “information already existing within the system that becomes relevant upon the occurrence of an event”;
- “inferring” - “logical process by which a factual conclusion is derived from known facts by the application of logical rules”;
- “inferring . . . a context in which the event occurred” - “logical process by which the fact that information already existing within the system that becomes relevant upon the occurrence of an event is derived by application of logical rules”;

My analysis construes the other terms of this element in accordance with their ordinary and customary meaning to one of ordinary skill in the art during the time frame of October 1995.

**Claim 3 - analysis by Dr. Cook of the Stone Reference**

Dr. Cook's analysis of this element is as follows:

[Claim 1 chart incorporated by reference]

"Using the guest's name, the system produces a display containing the guest's previous stays and their preferences with respect to room characteristics. The reservationist then switches to a second display which is a form to enter the guest's needs. Given the information regarding previous stays and current room preferences and each room's characteristics, the expert system suggests available rooms during the proposed stay of the guest." (Expert Systems and Sales Strategies, p. 54-55)

**Claim 3 - my analysis of the Stone Reference**

See claim elements missing from Claim 1.

The Stone Reference does not perform this claim element: "wherein the inferred context information related to whether a previous event has occurred in the sales process."

Among other things, whereas it can be said that the Stone Reference does contain "context" ["information already existing within the system that becomes relevant upon the occurrence of an event"] that includes "information related to whether a previous event has occurred in the sales process" insofar as the system uses information sources including "previous stays" and "room preferences", still, the Stone Reference does not describe that the context was inferred using a "logical process by which a factual conclusion is derived from known facts by the application of logical rules". The Stone Reference does not describe an event manager that "detect[s] . . . infer[s] . . . and automatically initiat[es] an operation" as required by Claim 1 or that any inference step that is part of an event takes place.

#### **VI.G. Claim 5 in view of the Stone Reference**

##### **Claim 5, element a - language**

- "[A system as recited in claim 1, wherein the plurality of subsystems comprises:] a time with customer subsystem configured to convert a lead to a buying customer, so as to close a sale; and"

##### **Claim 5, element a - construction**

- "subsystem" - "a system that is part of a larger system"

My analysis construes the other terms of this element in accordance with their ordinary and customary meaning to one of ordinary skill in the art during the time frame of October 1995.

##### **Claim 5, element a - analysis by Dr. Cook of the Stone Reference**

Dr. Cook's analysis of this element is as follows:

[Claim 1 chart incorporated by reference]

Pages 54-55. When a returning guest calls the hotel to make a reservation, the reservationist enters the individual's name into the reservation system. Using the guest's name, the system produces a display containing the guest's previous stays and their preferences with respect to room characteristics. The reservationist then switches to a second 54 display which is a form to enter the guest's needs. Given the information regarding previous stays and current room preferences and each room's characteristics, the expert system suggests available rooms during the proposed stay of the guest. These suggestions are rooms which best fit the guest's preferences and needs while satisfying the hotel's management and sales strategies. Primary among these sales strategies is to minimize short term (one night) room vacancies.

##### **Claim 5, element a - my analysis of the Stone Reference**

See claim elements missing from Claim 1.

The Stone Reference performs the "time with customer" function – but "a returning guest [who] calls the hotel to make a reservation" is not a lead.



**Claim 5, element b - language**

- "a lead generation subsystem configured to convert a name to a potential customer."

**Claim 5, element b - construction**

- "subsystem" - "a system that is part of a larger system"

My analysis construes the other terms of this element in accordance with their ordinary and customary meaning to one of ordinary skill in the art during the time frame of October 1995.

**Claim 5, element b - analysis by Dr. Cook of the Stone Reference**

Dr. Cook's analysis of this element is as follows:

Pages 54-55. When a returning guest calls the hotel to make a reservation, the reservationist enters the individual's name into the reservation system. Using the guest's name, the system produces a display containing the guest's previous stays and their preferences with respect to room characteristics. The reservationist then switches to a second 54 display which is a form to enter the guest's needs. Given the information regarding previous stays and current room preferences and each room's characteristics, the expert system suggests available rooms during the proposed stay of the guest. These suggestions are rooms which best fit the guest's preferences and needs while satisfying the hotel's management and sales strategies. Primary among these sales strategies is to minimize short term (one night) room vacancies.

**Claim 5, element b - my analysis of the Stone Reference**

See claim elements missing from Claim 1.

The Stone Reference does not perform the claim element: "a lead generation subsystem configured to convert a name to a potential customer."

Among other things, the Stone Reference does not contain a lead generation subsystem.

The '525 Patent describes a lead generation subsystem as follows

"The lead generation component 102 is provided to assist sales personnel to identify leads, to generate qualified leads and to begin the sales process. The lead generation component may include, for example, automated systems designed to assist the sales personnel in carrying out such tasks as telemarketing, kiosk presentations, trade show demonstrations, database marketing, electronic advertising, etc. ['525 Patent, 4:22-27]

The only customer mentioned in the Stone Reference pp 54-55 quote above is “a returning guest calls the hotel to make a reservation.” There is no mention of using the system to generate new leads or even to entice pre-existing customers to return and there is no separate subsystem “lead generation subsystem” that shares information with a “time with customer subsystem.”

#### **VI.G. Claim 6 in view of the Stone Reference**

##### **Claim 6, element a - language**

- “[A system as recited in claim 1, wherein the plurality of subsystems comprises:] a time with customer subsystem configured to convert a lead to a buying customer, so as to close a sale; and”

##### **Claim 6, element a - construction**

- "subsystem" - "a system that is part of a larger system"

My analysis construes the other terms of this element in accordance with their ordinary and customary meaning to one of ordinary skill in the art during the time frame of October 1995.

##### **Claim 6, element a - analysis by Dr. Cook of the Stone Reference**

Dr. Cook’s analysis of this element is as follows:

[Claim 1 chart incorporated by reference]

Pages 54-55. When a returning guest calls the hotel to make a reservation, the reservationist enters the individual's name into the reservation system. Using the guest's name, the system produces a display containing the guest's previous stays and their preferences with respect to room characteristics. The reservationist then switches to a second 54 display which is a form to enter the guest's needs. Given the information regarding previous stays and current room preferences and each room's characteristics, the expert system suggests available rooms during the proposed stay of the guest. These suggestions are rooms which best fit the guest's preferences and needs while satisfying the hotel's management and sales strategies. Primary among these sales strategies is to minimize short term (one night) room vacancies.

**Claim 6, element a - my analysis of the Stone Reference**

See claim elements missing from Claim 1.

See discussion for Claim 5a which is incorporated herein by reference.

**Claim 6, element b - language**

- "an order management subsystem configured to convert the sale such that a product or service delivered matches a product or service sold."

**Claim 6, element b - construction**

- "subsystem" - "a system that is part of a larger system"

My analysis construes the other terms of this element in accordance with their ordinary and customary meaning to one of ordinary skill in the art during the time frame of October 1995.

**Claim 6, element b - analysis by Dr. Cook of the Stone Reference**

Dr. Cook's analysis of this element is as follows:

Pages 54-55. When a returning guest calls the hotel to make a reservation, the reservationist enters the individual's name into the reservation system. Using the guest's name, the system produces a display containing the guest's previous stays and their preferences with respect to room characteristics. The reservationist then switches to a second 54 display which is a form to enter the guest's needs. Given the information regarding previous stays and current room preferences and each room's characteristics, the expert system suggests available rooms during the proposed stay of the guest. These suggestions are rooms which best fit the guest's preferences and needs while satisfying the hotel's management and sales strategies. Primary among these sales strategies is to minimize short term (one night) room vacancies.

**Claim 6, element b - my analysis of the Stone Reference**

See claim elements missing from Claim 1.

The Stone Reference does not perform the claim element: "an order management subsystem configured to convert the sale such that a product or service delivered matches a product or service sold."

Among other things, the Stone Reference does not contain an order management subsystem. The '525 Patent describes an order management subsystem as follows

"The order management component 106 assists sales personnel in efficiently managing the critical sales process phase that encompasses the time between the purchase decision and the time the product or service is delivered. For some products or services, this could be a short period of time, while for others it may be many months or even years. The order management component 106 allows the sales personnel to electronically manage changes and provide needed information to the customer during this critical time." ['525 Patent, 5:31-39]

The Stone Reference aids in making a sale but provides no description of after-sale follow-up.

#### **VI.G. Claim 7 in view of the Stone Reference**

##### **Claim 7, element a - language**

- "[A system as recited in claim 1, wherein the plurality of subsystems comprises:] a time with customer subsystem configured to convert a lead to a buying customer, so as to close a sale; and"

##### **Claim 7, element a - construction**

- "subsystem" - "a system that is part of a larger system"

My analysis construes the other terms of this element in accordance with their ordinary and customary meaning to one of ordinary skill in the art during the time frame of October 1995.

##### **Claim 7, element a - analysis by Dr. Cook of the Stone Reference**

Dr. Cook's analysis of this element is as follows:

[Claim 1 chart incorporated by reference]

Pages 54-55. When a returning guest calls the hotel to make a reservation, the reservationist enters the individual's name into the reservation system. Using the guest's name, the system produces a display containing the guest's previous stays and their preferences with respect to room characteristics. The reservationist then switches to a second 54 display which is a form to enter the guest's needs. Given the information regarding previous stays and current room preferences and each room's characteristics, the expert system suggests available rooms during the proposed stay of the guest. These

suggestions are rooms which best fit the guest's preferences and needs while satisfying the hotel's management and sales strategies. Primary among these sales strategies is to minimize short term (one night) room vacancies.

**Claim 7, element a - my analysis of the Stone Reference**

See claim elements missing from Claim 1.

See discussion for Claim 5a which is incorporated herein by reference.

**Claim 7, element b - language**

- "a customer retention subsystem configured to convert an existing customer into a lead, so as to generate repeat sales."

**Claim 7, element b - construction**

- "subsystem" - "a system that is part of a larger system"

My analysis construes the other terms of this element in accordance with their ordinary and customary meaning to one of ordinary skill in the art during the time frame of October 1995.

**Claim 7, element b - analysis by Dr. Cook of the Stone Reference**

Dr. Cook's analysis of this element is as follows:

Pages 54-55. When a returning guest calls the hotel to make a reservation, the reservationist enters the individual's name into the reservation system. Using the guest's name, the system produces a display containing the guest's previous stays and their preferences with respect to room characteristics. The reservationist then switches to a second 54 display which is a form to enter the guest's needs. Given the information regarding previous stays and current room preferences and each room's characteristics, the expert system suggests available rooms during the proposed stay of the guest. These suggestions are rooms which best fit the guest's preferences and needs while satisfying the hotel's management and sales strategies. Primary among these sales strategies is to minimize short term (one night) room vacancies.

**Claim 7, element b - my analysis of the Stone Reference**

See claim elements missing from Claim 1.

The Stone Reference does not perform the claim element: "a customer retention subsystem configured to convert an existing customer into a lead, so as to generate repeat sales."

Among other things, the Stone Reference does not contain a customer retention subsystem. The '525 Patent describes a customer retention subsystem as follows

"A further core process component of preferred system 100 is the customer retention component 108. This component assists sales personnel during the phase of the sales process after delivery of the service or product purchased by the customer. Component 100 assists sales personnel in retaining a customer; this is accomplished through processes that ensure a customer remains satisfied with the purchase decision and that increase repeat sales opportunities." ['525 Patent, 5:65-6:5]

The only customer mentioned in the Stone Reference pp 54-55 quote above is "a returning guest calls the hotel to make a reservation." The purpose of the reservation system in the Stone Reference is to aid the reservationist in making a sale, not in after-sale customer retention, which is the described purpose of the customer retention subsystem.

#### **VI.G. Claim 8 in view of the Stone Reference**

##### **Claim 8, element a - language**

- "[A system as recited in claim 1, wherein the plurality of subsystems comprises:] a time with customer subsystem configured to convert a lead to a buying customer and prompting the buying customer to make a buying decision, so as to close a sale; and"

##### **Claim 8, element a - construction**

- "subsystem" - "a system that is part of a larger system"

My analysis construes the other terms of this element in accordance with their ordinary and customary meaning to one of ordinary skill in the art during the time frame of October 1995.

##### **Claim 8, element a - analysis by Dr. Cook of the Stone Reference**

Dr. Cook's analysis of this element is as follows:

[Claim 1 chart incorporated by reference]

Pages 54-55. When a returning guest calls the hotel to make a reservation, the reservationist enters the individual's name into the reservation system. Using the guest's

name, the system produces a display containing the guest's previous stays and their preferences with respect to room characteristics. The reservationist then switches to a second 54 display which is a form to enter the guest's needs. Given the information regarding previous stays and current room preferences and each room's characteristics, the expert system suggests available rooms during the proposed stay of the guest. These suggestions are rooms which best fit the guest's preferences and needs while satisfying the hotel's management and sales strategies. Primary among these sales strategies is to minimize short term (one night) room vacancies.

**Claim 8, element a - my analysis of the Stone Reference**

See claim elements missing from Claim 1.

See discussion for Claim 5a which is incorporated herein by reference.

The actual "prompting the buying customer to make a buying decision" is done by the reservationist aided by the system, not actually by the system

**Claim 8, element b - language**

- "a self management subsystem configured to assist a salesperson in managing sales information."

**Claim 8, element b - construction**

- "subsystem" - "a system that is part of a larger system"

My analysis construes the other terms of this element in accordance with their ordinary and customary meaning to one of ordinary skill in the art during the time frame of October 1995.

**Claim 8, element b - analysis by Dr. Cook of the Stone Reference**

Dr. Cook's analysis of this element is as follows:

[Claim 1 chart incorporated by reference]

Pages 54-55. When a returning guest calls the hotel to make a reservation, the reservationist enters the individual's name into the reservation system. Using the guest's name, the system produces a display containing the guest's previous stays and their preferences with respect to room characteristics. The reservationist then switches to a second 54 display which is a form to enter the guest's needs. Given the information regarding previous stays and current room preferences and each room's characteristics, the expert system suggests available rooms during the proposed stay of the guest. These

suggestions are rooms which best fit the guest's preferences and needs while satisfying the hotel's management and sales strategies. Primary among these sales strategies is to minimize short term (one night) room vacancies.

**Claim 8, element b - my analysis of the Stone Reference**

See claim elements missing from Claim 1.

The Stone Reference does not perform the claim element: "a self management subsystem configured to assist a salesperson in managing sales information."

Among other things, the Stone Reference does not contain a self management subsystem.

The '525 Patent describes a self management subsystem as follows

"The self management component 110 assists sales personnel to manage their opportunities, time, contacts, schedules, goals, tasks, etc." ['525 Patent, 6:30-32]

There is no description of such a subsystem in the Stone Reference.

**VI.G. Claim 10 in view of the Stone Reference**

**Claim 10, element a - language**

- "[A system as recited in claim 1, wherein the plurality of subsystems comprises:] a time with customer subsystem configured to convert a lead to a buying customer, so as to close a sale; and"

**Claim 10, element a - construction**

- "subsystem" - "a system that is part of a larger system"

My analysis construes the other terms of this element in accordance with their ordinary and customary meaning to one of ordinary skill in the art during the time frame of October 1995.

**Claim 10, element a - analysis by Dr. Cook of the Stone Reference**

Dr. Cook's analysis of this element is as follows:

[Claim 1 chart incorporated by reference]



Pages 54-55. When a returning guest calls the hotel to make a reservation, the reservationist enters the individual's name into the reservation system. Using the guest's name, the system produces a display containing the guest's previous stays and their preferences with respect to room characteristics. The reservationist then switches to a second 54 display which is a form to enter the guest's needs. Given the information regarding previous stays and current room preferences and each room's characteristics, the expert system suggests available rooms during the proposed stay of the guest. These suggestions are rooms which best fit the guest's preferences and needs while satisfying the hotel's management and sales strategies. Primary among these sales strategies is to minimize short term (one night) room vacancies.

**Claim 10, element a - my analysis of the Stone Reference**

See claim elements missing from Claim 1.

See discussion for Claim 5a which is incorporated herein by reference.

**Claim 10, element b - language**

- "a sales management subsystem configured to assist a sales manager in managing a plurality of salespeople."

**Claim 10, element b - construction**

- "subsystem" - "a system that is part of a larger system"

My analysis construes the other terms of this element in accordance with their ordinary and customary meaning to one of ordinary skill in the art during the time frame of October 1995.

**Claim 10, element b - analysis by Dr. Cook of the Stone Reference**

Dr. Cook's analysis of this element is as follows:

Pages 54-55. When a returning guest calls the hotel to make a reservation, the reservationist enters the individual's name into the reservation system. Using the guest's name, the system produces a display containing the guest's previous stays and their preferences with respect to room characteristics. The reservationist then switches to a second 54 display which is a form to enter the guest's needs. Given the information regarding previous stays and current room preferences and each room's characteristics, the expert system suggests available rooms during the proposed stay of the guest. These suggestions are rooms which best fit the guest's preferences and needs while satisfying the hotel's management and sales strategies. Primary among these sales strategies is to minimize short term (one night) room vacancies.

**Claim 10, element b - my analysis of the Stone Reference**

See claim elements missing from Claim 1.

The Stone Reference does not perform the claim element: "a sales management subsystem configured to assist a sales manager in managing a plurality of salespeople."

Among other things, the Stone Reference does not contain such a sales management subsystem "to assist a sales manager in managing a plurality of salespeople."

**VI.G. Claim 12 in view of the Stone Reference**

**Claim 12, element a - language**

- "[ A system as recited in claim 1, wherein the plurality of subsystems comprises:] a lead management subsystem configured to manage a conversion of a lead to a prospect and of the prospect to a buying customer, and"

**Claim 12, element a - construction**

- "subsystem" - "a system that is part of a larger system"

My analysis construes the other terms of this element in accordance with their ordinary and customary meaning to one of ordinary skill in the art during the time frame of October 1995.

**Claim 12, element a - analysis by Dr. Cook of the Stone Reference**

Dr. Cook's analysis of this element is as follows:

[Claim 1 chart incorporated by reference]

Pages 54-55. When a returning guest calls the hotel to make a reservation, the reservationist enters the individual's name into the reservation system. Using the guest's name, the system produces a display containing the guest's previous stays and their preferences with respect to room characteristics. The reservationist then switches to a second 54 display which is a form to enter the guest's needs. Given the information regarding previous stays and current room preferences and each room's characteristics, the expert system suggests available rooms during the proposed stay of the guest. These suggestions are rooms which best fit the guest's preferences and needs while satisfying

the hotel's management and sales strategies. Primary among these sales strategies is to minimize short term (one night) room vacancies.

**Claim 12, element a - my analysis of the Stone Reference**

See claim elements missing from Claim 1.

The Stone Reference does not describe a "lead management subsystem". See discussion for Claim 5b which is incorporated herein by reference.

**Claim 12, element b - language**

- "a self management subsystem configured to assist a salesperson in managing sales information."

**Claim 12, element b - construction**

- "subsystem" - "a system that is part of a larger system"

My analysis construes the other terms of this element in accordance with their ordinary and customary meaning to one of ordinary skill in the art during the time frame of October 1995.

**Claim 12, element b - analysis by Dr. Cook of the Stone Reference**

Dr. Cook's analysis of this element is as follows:

Pages 54-55. When a returning guest calls the hotel to make a reservation, the reservationist enters the individual's name into the reservation system. Using the guest's name, the system produces a display containing the guest's previous stays and their preferences with respect to room characteristics. The reservationist then switches to a second 54 display which is a form to enter the guest's needs. Given the information regarding previous stays and current room preferences and each room's characteristics, the expert system suggests available rooms during the proposed stay of the guest. These suggestions are rooms which best fit the guest's preferences and needs while satisfying the hotel's management and sales strategies. Primary among these sales strategies is to minimize short term (one night) room vacancies.

**Claim 12, element b - my analysis of the Stone Reference**

See claim elements missing from Claim 1.

The Stone Reference does not describe a “self-management subsystem”. See discussion for Claim 8b which is incorporated herein by reference.

#### **VI.G. Claim 20 in view of the Stone Reference**

##### **Claim 20, preamble - language**

- "A method of facilitating a sales process using a computer arrangement having a plurality of subsystems configured to facilitate one or more actions performed during at least one phase of the sales process, the method comprising the steps of:"

##### **Claim 20, preamble - construction**

- “Subsystem” - "a system that is part of a larger system";

My analysis construes the other terms of this element in accordance with their ordinary and customary meaning to one of ordinary skill in the art during the time frame of October 1995.

##### **Claim 20, preamble - analysis by Dr. Cook of the Stone Reference**

Dr. Cook’s analysis of this preamble is as follows:

The preamble is not a limitation.

The rapid growth of artificial intelligence, and more specifically expert systems, in business has generated a need for investigations concerning computer based intelligence systems within all facets of a business organization.” (Introduction, p.52)

The focus of this paper is the application of one type of information technology (expert systems) to one point along the business value chain (marketing and sales). (Theoretical Framework, p. 54)

“The expert system provides a comprehensive method to alter marketing and sales strategies (e.g., adjust room rates or promote special packages). In the past, manual systems had no such comprehensive method. Using the expert system, any adjustments in strategy can quickly and comprehensively be made by altering the appropriate parameters in the expert system.” (Expert Systems and Sales Strategies, p. 55)

**Claim 20, preamble - my analysis of the Stone Reference**

My analysis of the preamble for this method Claim is the same as my analysis for the preamble and Claim 1, element a combined.

**Claim 20, element a - language**

- "automatically detecting one or more changes in state characteristic of an event occurring in the sales process;"

**Claim 20, element a - construction**

- "Changes in state characteristic of an event" - "a change in a unique configuration of information within the system that is indicative of the occurrence of an event within the system.

My analysis construes the other terms of this element in accordance with their ordinary and customary meaning to one of ordinary skill in the art during the time frame of October 1995.

**Claim 20, element a - analysis by Dr. Cook of the Stone Reference**

Dr. Cook's analysis of this element is as follows:

"When a returning guest calls the hotel...the reservationist enters the individual's name into the reservation system. Using the guest's name, the system produces a display containing ..." The system relies on three factors. First, the continual updated history on each guest and guest stay in the hotel. Second, a complete listing of each room in the hotel and the characteristics of the room. Finally, a listing of the management's operation strategies for the hotel. Among these operation strategies is management's sales strategy for the hotel. (Expert Systems and Sales Strategies, p. 54)

**Claim 20, element a - my analysis of the Stone Reference**

The material differences between this element and the "detecting" of Claim 1, element b are that Claim 20 has the additional limitation of "automatically" detecting, and it involves detecting state changes in events occurring in the sales process, as opposed to Claim 1 which involves detecting state changes of events occurring in the system.

My analysis of this element is the same as my analysis for Claim 1, element b with the addition that is difficult to understand that the quote from p. 54 involves “automatically detecting” as the steps appear to follow a conventional procedure.

**Claim 20, element b - language**

- “Inferring occurrence of the event and a context in which the event occurred based at least in part on the detected changes in state; and”

**Claim 20, element b - construction**

- “Context” - “information already existing within the system that becomes relevant upon the occurrence of an event”;
- “Inferring” - “logical process by which a factual conclusion is derived from known facts by the application of logical rules”;
- “Inferring . . . a context in which the event occurred” - “logical process by which the fact that information already existing within the system that becomes relevant upon the occurrence of an event is derived by application of logical rules”;
- “Inferring occurrence of an event” - “logical process by which the fact that an event has occurred is derived by application of logical rules”;

My analysis construes the other terms of this element in accordance with their ordinary and customary meaning to one of ordinary skill in the art during the time frame of October 1995.

**Claim 20, element b - analysis by Dr. Cook of the Stone Reference**

Dr. Cook’s analysis of this element is as follows:

“Using the guest’s name, the system produces a display containing the guest’s previous stays and their preferences with respect to room characteristics. The reservationist then switches to a second display which is a form to enter the guest’s needs. Given the information regarding previous stays and current room preferences and each room’s characteristics, the expert system suggests available rooms during the proposed stay of the guest.” (Expert Systems and Sales Strategies, p. 54-55)

**Claim 20, element b - my analysis of the Stone Reference**

My analysis of this element for this method Claim is the same as my analysis for system Claim 1, element c.

**Claim 20, element c - language**

- “automatically initiating an operation in one or more particular subsystems of the computer to facilitate a new action based on the inferred context.”

**Claim 20, element c - construction**

- “Context” - “information already existing within the system that becomes relevant upon the occurrence of an event”;
- “Inferring” - “logical process by which a factual conclusion is derived from known facts by the application of logical rules”;
- “Inferring . . . a context in which the event occurred” - “logical process by which the fact that information already existing within the system that becomes relevant upon the occurrence of an event is derived by application of logical rules”;
- “Subsystem” - “a system that is part of a larger system”;

My analysis construes the other terms of this element in accordance with their ordinary and customary meaning to one of ordinary skill in the art during the time frame of October 1995.

**Claim 20, element c - analysis by Dr. Cook of the Stone Reference**

Dr. Cook’s analysis of this element is as follows:

“Given the information regarding previous stays and current room preferences and each room’s characteristics, the expert system suggests available rooms during the proposed stay of the guest. These suggestions are rooms which best fit the guest’s preferences and needs while satisfying the hotel’s management and sales strategies.” (Expert Systems and Sales Strategies, p. 55)

**Claim 20, element c - my analysis of the Stone Reference**

My analysis of this element is the same as my analysis for Claim 1, element d.

**VI.G. Claim 24 in view of the Stone Reference**

**Claim 24 - language**

- "A method as recited in claim 20, wherein the inferred context includes information related to at least one phase of the sales process."

**Claim 24 - construction**

- "context" - "information already existing within the system that becomes relevant upon the occurrence of an event";
- "inferring" - "logical process by which a factual conclusion is derived from known facts by the application of logical rules";
- "inferring . . . a context in which the event occurred" - "logical process by which the fact that information already existing within the system that becomes relevant upon the occurrence of an event is derived by application of logical rules";

My analysis construes the other terms of this element in accordance with their ordinary and customary meaning to one of ordinary skill in the art during the time frame of October 1995.

**Claim 24 - analysis by Dr. Cook of the Stone Reference**

Dr. Cook's analysis of this element is as follows:

[Claim 20 chart incorporated by reference]

Pages 54-55. When a returning guest calls the hotel to make a reservation, the reservationist enters the individual's name into the reservation system. Using the guest's name, the system produces a display containing the guest's previous stays and their preferences with respect to room characteristics. The reservationist then switches to a second 54 display which is a form to enter the guest's needs. Given the information regarding previous stays and current room preferences and each room's characteristics, the expert system suggests available rooms during the proposed stay of the guest. These suggestions are rooms which best fit the guest's preferences and needs while satisfying the hotel's management and sales strategies. Primary among these sales strategies is to minimize short term (one night) room vacancies.

The system relies on three factors. First, the continual updated history on each guest and guest stay in the hotel. Second, a complete listing of each room in the hotel and the characteristics of the room. Finally, a listing of the management's operation strategies for the hotel. Among these operation strategies is management's sales strategy for the hotel.



**Claim 24 - my analysis of the Stone Reference**

See claim elements missing from Claim 20.

See discussion for Claim 2 which is incorporated herein by reference.

**VI.G. Claim 34 in view of the Stone Reference**

**Claim 34, element a - language**

- "[A method as recited in claim 20, further comprising the steps of:] inferring occurrence of an event while converting a lead to a buying customer; and"

**Claim 34, element a - construction**

- "inferring" - "logical process by which a factual conclusion is derived from known facts by the application of logical rules";
- "inferring occurrence of an event" - "logical process by which the fact that an event has occurred is derived by application of logical rules";

My analysis construes the other terms of this element in accordance with their ordinary and customary meaning to one of ordinary skill in the art during the time frame of October 1995.

**Claim 34, element a - analysis by Dr. Cook of the Stone Reference**

Dr. Cook's analysis of this element is as follows:

[Claim 20 chart incorporated by reference]

Pages 54-55. When a returning guest calls the hotel to make a reservation, the reservationist enters the individual's name into the reservation system. Using the guest's name, the system produces a display containing the guest's previous stays and their preferences with respect to room characteristics. The reservationist then switches to a second 54 display which is a form to enter the guest's needs. Given the information regarding previous stays and current room preferences and each room's characteristics, the expert system suggests available rooms during the proposed stay of the guest. These suggestions are rooms which best fit the guest's preferences and needs while satisfying the hotel's management and sales strategies. Primary among these sales strategies is to minimize short term (one night) room vacancies.

The system relies on three factors. First, the continual updated history on each guest and guest stay in the hotel. Second, a complete listing of each room in the hotel and the characteristics of the room. Finally, a listing of the management's operation strategies for the hotel. Among these operation strategies is management's sales strategy for the hotel.

**Claim 34, element a - my analysis of the Stone Reference**

See claim elements missing from Claim 20.

See discussion for Claims 2 and 5b which are incorporated herein by reference. In the Stone Reference, there is no event described that converts a lead from a lead generation subsystem to become a buying customer which involves the time with customer subsystem. Indeed, there is no lead since the customer himself calls the hotel to make a reservation.

**Claim 34, element b - language**

- "using the particular subsystem to convert an existing customer into a lead, so as to generate repeat sales."

**Claim 34, element b - construction**

- "subsystem" - "a system that is part of a larger system"

My analysis construes the other terms of this element in accordance with their ordinary and customary meaning to one of ordinary skill in the art during the time frame of October 1995.

**Claim 34, element b - analysis by Dr. Cook of the Stone Reference**

Dr. Cook's analysis of this element is as follows:

Pages 54-55. When a returning guest calls the hotel to make a reservation, the reservationist enters the individual's name into the reservation system. Using the guest's name, the system produces a display containing the guest's previous stays and their preferences with respect to room characteristics. The reservationist then switches to a second 54 display which is a form to enter the guest's needs. Given the information regarding previous stays and current room preferences and each room's characteristics, the expert system suggests available rooms during the proposed stay of the guest. These suggestions are rooms which best fit the guest's preferences and needs while satisfying the hotel's management and sales strategies. Primary among these sales strategies is to minimize short term (one night) room vacancies.

The system relies on three factors. First, the continual updated history on each guest and guest stay in the hotel. Second, a complete listing of each room in the hotel and the characteristics of the room. Finally, a listing of the management's operation strategies for the hotel. Among these operation strategies is management's sales strategy for the hotel.

**Claim 34, element b - my analysis of the Stone Reference**

See claim elements missing from Claim 20.

The Stone Reference does not perform this claim element: "using the particular subsystem to convert an existing customer into a lead, so as to generate repeat sales."

Among other things, while the "returning customer" in the Stone Reference pp54-55 simply may choose to make a reservation. They might later cancel and may never be entered into the previous stays database. Also, there is no description of using this system to create leads for a later potential sales event.

**VI.G. Claim 35 in view of the Stone Reference**

**Claim 35, element a - language**

- "A method as recited in claim 20, further comprising the steps of: inferring occurrence of an event while converting a lead to a buying customer and prompting the buying customer to make a buying decision; and"

**Claim 35, element a - construction**

- "inferring" - "logical process by which a factual conclusion is derived from known facts by the application of logical rules";
- "inferring occurrence of an event" - "logical process by which the fact that an event has occurred is derived by application of logical rules";

My analysis construes the other terms of this element in accordance with their ordinary and customary meaning to one of ordinary skill in the art during the time frame of October 1995.

**Claim 35, element a - analysis by Dr. Cook of the Stone Reference**

Dr. Cook's analysis of this element is as follows:

[Claim 20 chart incorporated by reference]

Pages 54-55. When a returning guest calls the hotel to make a reservation, the reservationist enters the individual's name into the reservation system. Using the guest's name, the system produces a display containing the guest's previous stays and their preferences with respect to room characteristics. The reservationist then switches to a second 54 display which is a form to enter the guest's needs. Given the information regarding previous stays and current room preferences and each room's characteristics, the expert system suggests available rooms during the proposed stay of the guest. These suggestions are rooms which best fit the guest's preferences and needs while satisfying the hotel's management and sales strategies. Primary among these sales strategies is to minimize short term (one night) room vacancies.

The system relies on three factors. First, the continual updated history on each guest and guest stay in the hotel. Second, a complete listing of each room in the hotel and the characteristics of the room. Finally, a listing of the management's operation strategies for the hotel. Among these operation strategies is management's sales strategy for the hotel.

**Claim 35, element a - my analysis of the Stone Reference**

See claim elements missing from Claim 20.

See discussion for Claim 34 which is incorporated herein by reference.

**Claim 35, element b - language**

- "using the particular subsystem to assist a salesperson in managing sales information."

**Claim 35, element b - construction**

- "subsystem" - "a system that is part of a larger system"

My analysis construes the other terms of this element in accordance with their ordinary and customary meaning to one of ordinary skill in the art during the time frame of October 1995.

**Claim 35, element b - analysis by Dr. Cook of the Stone Reference**

Dr. Cook's analysis of this element is as follows:

Pages 54-55. When a returning guest calls the hotel to make a reservation, the reservationist enters the individual's name into the reservation system. Using the guest's name, the system produces a display containing the guest's previous stays and their preferences with respect to room characteristics. The reservationist then switches to a second 54 display which is a form to enter the guest's needs. Given the information regarding previous stays and current room preferences and each room's characteristics, the expert system suggests available rooms during the proposed stay of the guest. These suggestions are rooms which best fit the guest's preferences and needs while satisfying the hotel's management and sales strategies. Primary among these sales strategies is to minimize short term (one night) room vacancies.

The system relies on three factors. First, the continual updated history on each guest and guest stay in the hotel. Second, a complete listing of each room in the hotel and the characteristics of the room. Finally, a listing of the management's operation strategies for the hotel. Among these operation strategies is management's sales strategy for the hotel.

#### **Claim 35, element b - my analysis of the Stone Reference**

See claim elements missing from Claim 20.

The Stone Reference does not perform "using the particular subsystem to assist a salesperson in managing sales information." See discussion for Claim 12b which is incorporated herein by reference.

#### **VI.G. Claim 37 in view of the Stone Reference**

##### **Claim 37, element a - language**

- "[A method as recited in claim 20, further comprising the steps of:] inferring occurrence of an event while converting a lead to a buying customer; and"

##### **Claim 37, element a - construction**

- "inferring" - "logical process by which a factual conclusion is derived from known facts by the application of logical rules";
- "inferring occurrence of an event" - "logical process by which the fact that an event has occurred is derived by application of logical rules";

My analysis construes the other terms of this element in accordance with their ordinary and customary meaning to one of ordinary skill in the art during the time frame of October 1995.

**Claim 37, element a - analysis by Dr. Cook of the Stone Reference**

Dr. Cook's analysis of this element is as follows:

[Claim 20 chart incorporated by reference]

Pages 54-55. When a returning guest calls the hotel to make a reservation, the reservationist enters the individual's name into the reservation system. Using the guest's name, the system produces a display containing the guest's previous stays and their preferences with respect to room characteristics. The reservationist then switches to a second 54 display which is a form to enter the guest's needs. Given the information regarding previous stays and current room preferences and each room's characteristics, the expert system suggests available rooms during the proposed stay of the guest. These suggestions are rooms which best fit the guest's preferences and needs while satisfying the hotel's management and sales strategies. Primary among these sales strategies is to minimize short term (one night) room vacancies.

The system relies on three factors. First, the continual updated history on each guest and guest stay in the hotel. Second, a complete listing of each room in the hotel and the characteristics of the room. Finally, a listing of the management's operation strategies for the hotel. Among these operation strategies is management's sales strategy for the hotel.

**Claim 37, element a - my analysis of the Stone Reference**

See claim elements missing from Claim 20.

See discussion for Claims 2 and 5b which are incorporated herein by reference. There is no event described that converts a lead from a lead generation subsystem to become a buying customer which involves the time with customer subsystem. Indeed, there is no lead since the customer himself calls the hotel to make a reservation.

**Claim 37, element b - language**

- "using the particular subsystem to assist a sales manager in managing a plurality of salespeople."

**Claim 37, element b - construction**

- "subsystem" - "a system that is part of a larger system"

My analysis construes the other terms of this element in accordance with their ordinary and customary meaning to one of ordinary skill in the art during the time frame of October 1995.

**Claim 37, element b - analysis by Dr. Cook of the Stone Reference**

Dr. Cook's analysis of this element is as follows:

Pages 54-55. When a returning guest calls the hotel to make a reservation, the reservationist enters the individual's name into the reservation system. Using the guest's name, the system produces a display containing the guest's previous stays and their preferences with respect to room characteristics. The reservationist then switches to a second 54 display which is a form to enter the guest's needs. Given the information regarding previous stays and current room preferences and each room's characteristics, the expert system suggests available rooms during the proposed stay of the guest. These suggestions are rooms which best fit the guest's preferences and needs while satisfying the hotel's management and sales strategies. Primary among these sales strategies is to minimize short term (one night) room vacancies.

The system relies on three factors. First, the continual updated history on each guest and guest stay in the hotel. Second, a complete listing of each room in the hotel and the characteristics of the room. Finally, a listing of the management's operation strategies for the hotel. Among these operation strategies is management's sales strategy for the hotel.

**Claim 37, element b - my analysis of the Stone Reference**

See claim elements missing from Claim 20.

The Stone Reference does not perform "using the particular subsystem to assist a sales manager in managing a plurality of salespeople." See discussion for Claim 10b which is incorporated herein by reference.

**VI.G. Claim 40 in view of the Stone Reference**

**Claim 40, element, preamble - language**

- "A computer implemented sales system used to facilitate a sales process, the system comprising:"

**Claim 40, preamble - construction**

The Court has not construed this preamble. My analysis construes the terms of this preamble in accordance with their ordinary and customary meaning to one of ordinary skill in the art during the time frame of October 1995.

**Claim 40, preamble - analysis by Dr. Cook of the Stone Reference**

Dr. Cook's analysis of this preamble is as follows:

The preamble is not a limitation.

The rapid growth of artificial intelligence, and more specifically expert systems, in business has generated a need for investigations concerning computer based intelligence systems within all facets of a business organization." (Introduction, p.52)

The focus of this paper is the application of one type of information technology (expert systems) to one point along the business value chain (marketing and sales). (The Theoretical Framework, p. 54)

"The expert system provides a comprehensive method to alter marketing and sales strategies (e.g., adjust room rates or promote special packages). In the past, manual systems had no such comprehensive method. Using the expert system, any adjustments in strategy can quickly and comprehensively be made by altering the appropriate parameters in the expert system." (Expert Systems and Sales Strategies, p. 55)

**Claim 40, preamble - my analysis of the Stone Reference**

My analysis of this preamble is the same as my analysis for Claim 1, preamble.

**Claim 40, element a - language**

- "a plurality of subsystems configured to electronically facilitate actions performed during the sales process; and"



**Claim 40, element a - construction**

- “Subsystem” - “a system that is part of a larger system”;

My analysis construes the other terms of this element in accordance with their ordinary and customary meaning to one of ordinary skill in the art during the time frame of October 1995.

**Claim 40, element a - analysis by Dr. Cook of the Stone Reference**

Dr. Cook’s analysis of this element is as follows:

The focus of this paper is the application of one type of information technology (expert systems) to one point along the business value chain (marketing and sales). (The Theoretical Framework, p. 54)

“The expert system provides a comprehensive method to alter marketing and sales strategies (e.g., adjust room rates or promote special packages). In the past, manual systems had no such comprehensive method. Using the expert system, any adjustments in strategy can quickly and comprehensively be made by altering the appropriate parameters in the expert system.” (Expert Systems and Sales Strategies, p. 55)

**Claim 40, element a - my analysis of the Stone Reference**

My analysis of this element is the same as my analysis for Claim 1, element a.

**Claim 40, element b - language**

- “an event manager coupled to the subsystems and configured to detect one or more changes in state characteristic of an event occurring in the system,”

**Claim 40, element b - construction**

- “Event manager” - “hardware and/or software”;
- “Subsystem” - “a system that is part of a larger system”;
- “Changes in state characteristic of an event” - “a change in a unique configuration of information within the system that is indicative of the occurrence of an event within the system.”

My analysis construes the other terms of this element in accordance with their ordinary and customary meaning to one of ordinary skill in the art during the time frame of October 1995.

**Claim 40, element b - analysis by Dr. Cook of the Stone Reference**

Dr. Cook's analysis of this element is as follows:

Pages 54-55. When a returning guest calls the hotel to make a reservation, the reservationist enters the individual's name into the reservation system. Using the guest's name, the system produces a display containing the guest's previous stays and their preferences with respect to room characteristics. The reservationist then switches to a second 54 display which is a form to enter the guest's needs. Given the information regarding previous stays and current room preferences and each room's characteristics, the expert system suggests available rooms during the proposed stay of the guest. These suggestions are rooms which best fit the guest's preferences and needs while satisfying the hotel's management and sales strategies. Primary among these sales strategies is to minimize short term (one night) room vacancies.

The system relies on three factors. First, the continual updated history on each guest and guest stay in the hotel. Second, a complete listing of each room in the hotel and the characteristics of the room. Finally, a listing of the management's operation strategies for the hotel. Among these operation strategies is management's sales strategy for the hotel.

**Claim 40, element b - my analysis of the Stone Reference**

My analysis of this element is the same as my analysis for Claim 1, element b.

**Claim 40, element c - language**

- "Infer occurrence of the event and a context in which the event occurred based at least in part on the detected changes in state,"

**Claim 40, element c - construction**

- "Context" - "information already existing within the system that becomes relevant upon the occurrence of an event";
- "Inferring" - "logical process by which a factual conclusion is derived from known facts by the application of logical rules";
- "Inferring . . . a context in which the event occurred" - "logical process by which the fact that information already existing within the system that becomes relevant upon the occurrence of an event is derived by application of logical rules";
- "Inferring occurrence of an event" - "logical process by which the fact that an event has occurred is derived by application of logical rules";

My analysis construes the other terms of this element in accordance with their ordinary and customary meaning to one of ordinary skill in the art during the time frame of October 1995.

**Claim 40, element c - analysis by Dr. Cook of the Stone Reference**

Dr. Cook's analysis of this element is as follows:

"Using the guest's name, the system produces a display containing the guest's previous stays and their preferences with respect to room characteristics. The reservationist then switches to a second display which is a form to enter the guest's needs. Given the information regarding previous stays and current room preferences and each room's characteristics, the expert system suggests available rooms during the proposed stay of the guest." (Expert Systems and Sales Strategies, p. 54-55)

**Claim 40, element c - my analysis of the Stone Reference**

My analysis of this element is the same as my analysis for Claim 1, element c.

**Claim 40, element d - language**

- "Link the inferred event with an action to be performed during the sales process based on prior sales experience using the sales system, and"

**Claim 40, element d - construction**

- "Inferring" - "logical process by which a factual conclusion is derived from known facts by the application of logical rules";

My analysis construes the other terms of this element in accordance with their ordinary and customary meaning to one of ordinary skill in the art during the time frame of October 1995.

**Claim 40, element d - analysis by Dr. Cook of the Stone Reference**

Dr. Cook's analysis of this element is as follows:

"Using the guest's name, the system produces a display containing the guest's previous stays and their preferences with respect to room characteristics. The reservationist then switches to a second display which is a form to enter the guest's needs. Given the information regarding previous stays and current room preferences and each room's characteristics, the expert system

suggests available rooms during the proposed stay of the guest.” (Expert Systems and Sales Strategies, p. 54-55)

**Claim 40, element d - my analysis of the Stone Reference**

The Cook reference (p54-55) does not provide enough information to determine whether it meets this Claim element: "Link the inferred event with an action to be performed during the sales process based on prior sales experience using the sales system".

**Claim 40, element e - language**

- "Automatically initiate an operation using one or more of the plurality of subsystems to facilitate the action to be performed based on the inferred context."

**Claim 40, element e - construction**

- "Context" - "information already existing within the system that becomes relevant upon the occurrence of an event";
- "Inferring" - "logical process by which a factual conclusion is derived from known facts by the application of logical rules";
- "Inferring . . . a context in which the event occurred" - "logical process by which the fact that information already existing within the system that becomes relevant upon the occurrence of an event is derived by application of logical rules";
- "Subsystem" - "a system that is part of a larger system";

My analysis construes the other terms of this element in accordance with their ordinary and customary meaning to one of ordinary skill in the art during the time frame of October 1995.

**Claim 40, element e - analysis by Dr. Cook of the Stone Reference**

Dr. Cook's analysis of this element is as follows:

“Given the information regarding previous stays and current room preferences and each room's characteristics, the expert system suggests available rooms during the proposed stay of the guest. These suggestions are rooms which best fit the guest's preferences and needs while satisfying the hotel's management and sales strategies.” (Expert Systems and Sales Strategies, p. 55)

**Claim 40, element e - my analysis of the Stone Reference**

My analysis of this element is the same as my analysis for Claim 1, element d.

***VI.H AN APPROACH TO REDUCING DELAYS IN RECOGNIZING DISTRIBUTED  
EVENT OCCURRENCES BY SPEZIALETTI (THE "SPEZIALETTI REFERENCE")***

**VI.H General Overview of Spezialetti Reference**

**The Spezialetti Reference**

- M. Spezialetti, "An Approach to Reducing Delays in Recognizing Distributed Event Occurrences," *Proceedings of the 1991 ACM/ONR Workshop on Parallel and Distributed Debugging*, Santa Cruz, California, 1991, pp. 155 - 166, available from Association of Computer Machinery 0-89791-457-0/91/0011/0155

**Claims at Issue**

The Cook Report states that "Spezialetti, Madalene: An Approach to Reducing Delays in Recognizing Distributed Event Occurrences, Association of Computer Machinery 0-89791-457-0/91/0011/0155 renders all claims obvious, either alone or in combination with other references herein." (Cook Report, p323)

**Dr. Cook's Summary of the Spezialetti Reference (quoted from his Expert Report)**

"177. Spezialetti teaches an approach to reduce the internal system delay in event recognition by incorporating knowledge about the characteristics of behaviors to be recognized in an evaluation process. In the system an event manager/monitor is disclosed at each processor in which a component of a particular event is located. This event manager/monitor maintains information pertaining to the states of each component of the event located at that processor.

"178. In the system, users can describe activities of interest in the form of event definitions. These definitions are predicates which test the states of various system elements. The activity of the elements specified by an event definition is monitored, and data pertaining to their activity collected for analysis. Data is organized into computation state views, and event definitions are evaluated in terms of states of their operands. When the behavior of the computation fulfills the specification of its definition, an inference that the event has occurred takes place.

"179. While the Spezialetti publication does not specifically disclose a use of its' teachings directed to a sales process; however, one of ordinary skill would certainly recognize the advantages provided by event recognition based upon detected changes in state, and predictably adapt the disclosures to a sales system."

### **My Summary of the Spezialetti Reference**

The Spezialetti Reference considers the technical problem of how to monitor for situations where complex events occur in the context of operating systems and distributed processes. Examples of simple events are "process A reached line 1000," "process B wrote to file F," and "process C has terminated," [Spezialetti, p158]. Complex event predicates (e.g., " $((A.x < 3) \text{ AND } (B.y > 5))$ ") [p159] which involves testing element x at process A and element y at process B) combine simple events with logical operators AND and OR and temporal operators (e.g., "EI [ E2" is TRUE when "E2 becomes TRUE after E1 has become TRUE") [Spezialetti, p156]. The main result of the paper is to develop a strategy whereby complex events will be recognized faster. This can be accomplished in part by efficiently assigning leaf event and complex event monitors to distributed machines, thereby avoiding sending all monitoring events to one global monitor which could otherwise be overwhelmed. In addition, any events that become true and remain true can be cached locally at complex event monitors.

### **Dr. Cook's Analysis of the Spezialetti Reference from his Expert Report pp. 38-39 (quoted)**

176. I considered and analyzed Spezialetti, Madalene: An Approach to Reducing Delays in Recognizing Distributed Event Occurrences ("the Spezialetti publication"). The Spezialetti publication was "known or used by others" in the United States prior to the October 30, 1994 critical date for the '525 Patent.

177. Spezialetti teaches an approach to reduce the internal system delay in event recognition by incorporating knowledge about the characteristics of behaviors to be recognized in an evaluation process. In the system an event manager/monitor is disclosed at each processor in which a component of a particular event is located. This event manager/monitor maintains information pertaining to the states of each component of the event located at that processor.

178. In the system, users can describe activities of interest in the form of event definitions. These definitions are predicates which test the states of various system elements. The activity of the elements specified by an event definition is monitored, and data pertaining to their activity collected for analysis. Data is organized into computation state views, and event definitions are evaluated in terms of states of their operands.

When the behavior of the computation fulfills the specification of its definition, an inference that the event has occurred takes place.

179. While the Spezialetti publication does not specifically disclose a use of its' teachings directed to a sales process; however, one of ordinary skill would certainly recognize the advantages provided by event recognition based upon detected changes in state, and predictably adapt the disclosures to a sales system.

180. The foregoing description is by way of example only and is intended to illustrate, in general terms, the functionality of the described system to provide context. As I discuss in the Claim chart, it is my opinion that under the Court's constructions, the Spezialetti publication renders all Claims obvious, either alone or in combination with other references herein.

181. A detailed analysis of how this reference renders obvious the asserted Claims of the '525 Patent is provided in Appendix C, pages 323-331.

### **Relevance of the Spezialetti Reference to the '525 Patent**

The Spezialetti Reference does not describe or even mention sales force automation. The paper provides a framework for monitoring for conditions in a distributed environment. The paper does not indicate whether the system described has been implemented and does not describe the architecture of the system in terms of systems and subsystems (other than to identify distributed event monitors and processes being monitored). The paper does not describe how the user specifies simple events and does not describe an action to take when an event occurs, other than generically to notify the user's view. The Spezialetti paper describes one possible design for part of an event manager that could have been implemented as an embodiment of the '525 Patent – the portion of the event manager that describes events and monitors for events, not the portion that determines what inference(s) to draw or what action[s] to take or takes action.

In addition, the Spezialetti Reference is similar to, and hence cumulative to, much of the prior art that was before the examiner during the prosecution of the '525 Patent. For example, the Spezialetti Reference is cumulative to the following systems which, I understand, were developed by the assignee of the '525 Patent – Clear with Computers: (i) the ISIS System, which



was of record during the prosecution of the '525 Patent; and (ii) the Truck Force Tools System which was of record during the prosecution of the '525 Patent. In addition, the Spezialetti Reference is cumulative to a number of the United States Patents that were considered by the examiner during the prosecution of the '525 Patent.

#### **VI.H. Claim 1 in view of the Spezialetti Reference**

##### **Claim 1, preamble - language**

- "A computer implemented sales system used to facilitate a sales process, the system comprising:"

##### **Claim 1, preamble - construction**

The Court has not construed this preamble. My analysis construes the terms of this preamble in accordance with their ordinary and customary meaning to one of ordinary skill in the art during the time frame of October 1995.

##### **Claim 1, preamble - analysis by Dr. Cook of the Spezialetti Reference**

Dr. Cook's analysis of this preamble is as follows:

The preamble is not a limitation.

##### **Claim 1, preamble - my analysis of the Spezialetti Reference**

The Court has not construed this preamble. That said, the Spezialetti Reference does not describe "a sales system used to facilitate a sales process." The '525 Patent title "Integrated Computerized Sales Force Automation System" implies a sales force. The first paragraph of the *Background of the Invention* states

"The present invention is directed to a sales force automation system and, more particularly, to an automated sales system which facilitates the sale of an item or service

by intelligently integrating into a single system tools used by a salesperson in the sales process." ['525 Patent, 1:5-9]

**Claim 1, element a - language**

- "a plurality of subsystems configured to facilitate one or more actions performed during at least one phase of the sales process; and"

**Claim 1, element a - construction**

- "Subsystem" - "a system that is part of a larger system";

My analysis construes the other terms of this element in accordance with their ordinary and customary meaning to one of ordinary skill in the art during the time frame of October 1995.

**Claim 1, element a - analysis by Dr. Cook of the Spezialetti Reference**

Dr. Cook's analysis of this element is as follows:

Pages 156. At each processor at which a component of a particular event is located is an event monitor. This monitor will maintain information pertaining to the states of each component of the event which is located at that processor.

**Claim 1, element a - my analysis of the Spezialetti Reference**

The Spezialetti Reference does not perform this Claim element: "a plurality of subsystems configured to facilitate one or more actions performed during at least one phase of the sales process;"

In particular, the Spezialetti Reference does not "facilitate one or more actions performed during at least one phase of the sales process". The Spezialetti Reference does not take actions beyond the fixed action of displaying a record of events it detects nor does it aid a salesperson who is part of a sales force – see Claim 1, Preamble.

**Claim 1, element b - language**

- "an event manager, coupled to the subsystems, the event manager detecting one or more changes in state characteristic of an event occurring within the system,"

**Claim 1, element b - construction**

- “Subsystem” - “a system that is part of a larger system”;
- “Event manager” - “hardware and/or software”;
- “Changes in state characteristic of an event” - “a change in a unique configuration of information within the system that is indicative of the occurrence of an event within the system”;

My analysis construes the other terms of this element in accordance with their ordinary and customary meaning to one of ordinary skill in the art during the time frame of October 1995.

**Claim 1, element b - analysis by Dr. Cook of the Spezialetti Reference**

Dr. Cook’s analysis of this element is as follows:

Page 155. “One approach to aid in this analysis allows users to describe activity of interest in the form of event definitions. These definitions are predicates which test the states of various system elements. The activity of the elements specified by an event definition is monitored, and data pertaining to their activity collected for analysis. This data is organized into a view of the computation state, and the event definition is evaluated in terms of the states of its operands. An event occurs at the point that the behavior of the computation fulfills the specification of its definition, that is, at the point that the application of the definition’s operators to the states of the operands would yield a TRUE result. An occurrence of the event is recognized at the point that the monitoring system detects its occurrence.”

Page 156. “An event definition is a description of the activity which is to be detected by a monitoring system.”

Page 156. “An event definition is assumed to be a predicate whose operands, or components, are combined or tested using relational, logical or temporal operators.”

Page 156. “In order to recognize an event occurrence, data regarding the states of the components must be collected and evaluated.”

Page 157. “Associated with each process is a component monitor, which is responsible for detecting changes to the monitored components within that process and, when an alteration occurs to a component, transmitting the value of that alteration to the appropriate event monitor.”

Page 162. “When a change occurs to a monitored component in a region, r, which may result in an occurrence of an event, the component’s event monitor is informed of the change.”

**Claim 1, element b - my analysis of the Spezialetti Reference**

The Spezialetti Reference performs this Claim element: "an event manager, coupled to the subsystems, the event manager detecting one or more changes in state characteristic of an event occurring within the system,"

**Claim 1, element c - language**

- "Inferring occurrence of the event and a context in which the event occurred based at least in part on the detected changes in state, and"

**Claim 1, element c - construction**

- "Context" - "information already existing within the system that becomes relevant upon the occurrence of an event";
- "Inferring" - "logical process by which a factual conclusion is derived from known facts by the application of logical rules";
- "Inferring . . . a context in which the event occurred" - "logical process by which the fact that information already existing within the system that becomes relevant upon the occurrence of an event is derived by application of logical rules";
- "Inferring occurrence of an event" - "logical process by which the fact that an event has occurred is derived by application of logical rules";

My analysis construes the other terms of this element in accordance with their ordinary and customary meaning to one of ordinary skill in the art during the time frame of October 1995.

**Claim 1, element c - analysis by Dr. Cook of the Spezialetti Reference**

Dr. Cook's analysis of this element is as follows:

Page 155. "One approach to aid in this analysis allows users to describe activity of interest in the form of event definitions. These definitions are predicates which test the states of various system elements. The activity of the elements specified by an event definition is monitored, and data pertaining to their activity collected for analysis. This data is organized into a view of the computation state, and the event definition is evaluated in terms of the states of its operands. An event occurs at the point that the behavior of the computation fulfills the specification of its definition, that is, at the point that the application of the definition's operators to the states of the operands would yield a

TRUE result. An occurrence of the event is recognized at the point that the monitoring system detects its occurrence."

Page 157. "An evaluation monitor may be assigned the task of evaluating an entire event or some portion of an event and is responsible for accumulating and organizing the data which is required to perform the evaluation and potentially make recognitions. ... [W]henever discussing the assignment of evaluation responsibilities, the module will be referred to as an evaluation monitor, although it may serve as an event monitor as well."

Page 165. "[A] technique was presented to determine if an immediate recognition of an event's occurrence could be guaranteed via the placement of evolution monitors based on the characteristics of an event's operators."

**Claim 1, element c - my analysis of the Spezialetti Reference**

The Spezialetti Reference performs this Claim element: "Inferring occurrence of the event and a context in which the event occurred based at least in part on the detected changes in state,"

**Claim 1, element d - language**

- "automatically initiating an operation in one or more particular subsystems of the computer to facilitate a new action based on the inferred context."

**Claim 1, element d - construction**

- "Context" - "information already existing within the system that becomes relevant upon the occurrence of an event";
- "Subsystem" - "a system that is part of a larger system";
- "Inferring" - "logical process by which a factual conclusion is derived from known facts by the application of logical rules";
- "Inferring . . . a context in which the event occurred" - "logical process by which the fact that information already existing within the system that becomes relevant upon the occurrence of an event is derived by application of logical rules";

My analysis construes the other terms of this element in accordance with their ordinary and customary meaning to one of ordinary skill in the art during the time frame of October 1995.

**Claim 1, element d - analysis by Dr. Cook of the Spezialetti Reference**

Dr. Cook did not analyze this element.

**Claim 1, element d - my analysis of the Spezialetti Reference**

The Spezialetti Reference does not perform this Claim element: "automatically initiating an operation in one or more particular subsystems of the computer to facilitate a new action based on the inferred context." As mentioned, the Spezialetti Reference does not perform actions when an event monitored occurs other than the built in action to display the event.

**VI.H. Claim 20 in view of the Spezialetti Reference**

**Claim 20, preamble - language**

- "A method of facilitating a sales process using a computer arrangement having a plurality of subsystems configured to facilitate one or more actions performed during at least one phase of the sales process, the method comprising the steps of:"

**Claim 20, preamble - construction**

- "Subsystem" - "a system that is part of a larger system";

My analysis construes the other terms of this element in accordance with their ordinary and customary meaning to one of ordinary skill in the art during the time frame of October 1995.

**Claim 20, preamble - analysis by Dr. Cook of the Spezialetti Reference**

Dr. Cook's analysis of this preamble is as follows:

The preamble is not a limitation.

Nonetheless, Pages 156. At each processor at which a component of a particular event is located is an event monitor. This monitor will maintain information pertaining to the states of each component of the event which is located at that processor.

**Claim 20, preamble - my analysis of the Spezialetti Reference**

My analysis of the preamble for this method Claim is the same as my analysis for the preamble and Claim 1, element a combined.

**Claim 20, element a - language**

- "automatically detecting one or more changes in state characteristic of an event occurring in the sales process;"

**Claim 20, element a - construction**

- "Changes in state characteristic of an event" - "a change in a unique configuration of information within the system that is indicative of the occurrence of an event within the system.

My analysis construes the other terms of this element in accordance with their ordinary and customary meaning to one of ordinary skill in the art during the time frame of October 1995.

**Claim 20, element a - analysis by Dr. Cook of the Spezialetti Reference**

Dr. Cook's analysis of this element is as follows:

Page 155. "One approach to aid in this analysis allows users to describe activity of interest in the form of event definitions. These definitions are predicates which test the states of various system elements. The activity of the elements specified by an event definition is monitored, and data pertaining to their activity collected for analysis. This data is organized into a view of the computation state, and the event definition is evaluated in terms of the states of its operands. An event occurs at the point that the behavior of the computation fulfills the specification of its definition, that is, at the point that the application of the definition's operators to the states of the operands would yield a TRUE result. An occurrence of the event is recognized at the point that the monitoring system detects its occurrence."

Page 156. "an event definition is a description of the activity which is to be detected by a monitoring system."

Page 156. "An event definition is assumed to be a predicate whose operands, or components, are combined or tested using relational, logical or temporal operators."

Page 156. "In order to recognize an event occurrence, data regarding the states of the components must be collected and evaluated."

Page 157. "Associated with each process is a component monitor, which is responsible for detecting changes to the monitored components within that process and, when an alteration occurs to a component, transmitting the value of that alteration to the appropriate event monitor."

Page 162. "When a change occurs to a monitored component in a region, r, which may result in an occurrence of an event, the component's event monitor is informed of the change."

**Claim 20, element a - my analysis of the Spezialetti Reference**

The material differences between this element and the "detecting" of Claim 1, element b are that Claim 20 has the additional limitation of "automatically" detecting, and it involves detecting state changes in events occurring in the sales process, as opposed to Claim 1 which involves detecting state changes of events occurring in the system.

My analysis of this element is the same as my analysis for Claim 1, element b except the Spezialetti Reference does not describe an "event occurring in the sales process" nor does it aid a salesperson who is part of a sales force – see Claim 20, Preamble.

**Claim 20, element b - language**

- "Inferring occurrence of the event and a context in which the event occurred based at least in part on the detected changes in state; and"

**Claim 20, element b - construction**

- "Context" - "information already existing within the system that becomes relevant upon the occurrence of an event";
- "Inferring" - "logical process by which a factual conclusion is derived from known facts by the application of logical rules";
- "Inferring . . . a context in which the event occurred" - "logical process by which the fact that information already existing within the system that becomes relevant upon the occurrence of an event is derived by application of logical rules";
- "Inferring occurrence of an event" - "logical process by which the fact that an event has occurred is derived by application of logical rules";



My analysis construes the other terms of this element in accordance with their ordinary and customary meaning to one of ordinary skill in the art during the time frame of October 1995.

**Claim 20, element b - analysis by Dr. Cook of the Spezialetti Reference**

Dr. Cook's analysis of this element is as follows:

Page 155. "One approach to aid in this analysis allows users to describe activity of interest in the form of event definitions. These definitions are predicates which test the states of various system elements. The activity of the elements specified by an event definition is monitored, and data pertaining to their activity collected for analysis. This data is organized into a view of the computation state, and the event definition is evaluated in terms of the states of its operands. An event occurs at the point that the behavior of the computation fulfills the specification of its definition, that is, at the point that the application of the definition's operators to the states of the operands would yield a TRUE result. An occurrence of the event is recognized at the point that the monitoring system detects its occurrence."

Page 157. "An evaluation monitor may be assigned the task of evaluating an entire event or some portion of an event and is responsible for accumulating and organizing the data which is required to perform the evaluation and potentially make recognitions. ... [W]henever discussing the assignment of evaluation responsibilities, the module will be referred to as an evaluation monitor, although it may serve as an event monitor as well."

Page 165. "[A] technique was presented to determine if an immediate recognition of an event's occurrence could be guaranteed via the placement of evolution monitors based on the characteristics of an event's operators."

**Claim 20, element b - my analysis of the Spezialetti Reference**

My analysis of this element for this method Claim is the same as my analysis for system

Claim 1, element c.

**Claim 20, element c - language**

- "automatically initiating an operation in one or more particular subsystems of the computer to facilitate a new action based on the inferred context";

**Claim 20, element c - construction**

- "Context" - "information already existing within the system that becomes relevant upon the occurrence of an event";

- “Inferring” - “logical process by which a factual conclusion is derived from known facts by the application of logical rules”;
- “Inferring . . . a context in which the event occurred” - “logical process by which the fact that information already existing within the system that becomes relevant upon the occurrence of an event is derived by application of logical rules”;
- “Subsystem” - “a system that is part of a larger system”;

My analysis construes the other terms of this element in accordance with their ordinary and customary meaning to one of ordinary skill in the art during the time frame of October 1995.

**Claim 20, element c - analysis by Dr. Cook of the Spezialetti Reference**

Dr. Cook did not analyze this element.

**Claim 20, element c - my analysis of the Spezialetti Reference**

The Spezialetti Reference does not initiate actions when events are detected (other than viewing the detected event).

**VI.H. Claim 40 in view of the Spezialetti Reference**

**Claim 40, preamble - language**

- “A computer implemented sales system used to facilitate a sales process, the system comprising:”

**Claim 40, preamble - construction**

The Court has not construed this preamble. My analysis construes the terms of this preamble in accordance with their ordinary and customary meaning to one of ordinary skill in the art during the time frame of October 1995.

**Claim 40, preamble - analysis by Dr. Cook of the Spezialetti Reference**

Dr. Cook’s analysis of this preamble is as follows:

The preamble is not a limitation.

**Claim 40, preamble - my analysis of the Spezialetti Reference**

My analysis of this preamble is the same as my analysis for Claim 1, preamble.

**Claim 40, element a - language**

- "a plurality of subsystems configured to electronically facilitate actions performed during the sales process; and"

**Claim 40, element a - construction**

- "Subsystem" - "a system that is part of a larger system";

My analysis construes the other terms of this element in accordance with their ordinary and customary meaning to one of ordinary skill in the art during the time frame of October 1995.

**Claim 40, element a - analysis by Dr. Cook of the Spezialetti Reference**

Dr. Cook's analysis of this element is as follows:

Pages 156. At each processor at which a component of a particular event is located is an *event monitor*. This monitor will maintain information pertaining to the states of each component of the event which is located at that processor.

**Claim 40, element a - my analysis of the Spezialetti Reference**

My analysis of this element is the same as my analysis for Claim 1, element a.

**Claim 40, element b - language**

- "an event manager coupled to the subsystems and configured to detect one or more changes in state characteristic of an event occurring in the system,"

**Claim 40, element b - construction**

- "Event manager" - "hardware and/or software";
- "Subsystem" - "a system that is part of a larger system";
- "Changes in state characteristic of an event" - "a change in a unique configuration of information within the system that is indicative of the occurrence of an event within the system.

My analysis construes the other terms of this element in accordance with their ordinary and customary meaning to one of ordinary skill in the art during the time frame of October 1995.

**Claim 40, element b - analysis by Dr. Cook of the Spezialetti Reference**

Dr. Cook's analysis of this element is as follows:

Page 155. "One approach to aid in this analysis allows users to describe activity of interest in the form of event definitions. These definitions are predicates which test the states of various system elements. The activity of the elements specified by an event definition is monitored, and data pertaining to their activity collected for analysis. This data is organized into a view of the computation state, and the event definition is evaluated in terms of the states of its operands. An event occurs at the point that the behavior of the computation fulfills the specification of its definition, that is, at the point that the application of the definition's operators to the states of the operands would yield a TRUE result. An occurrence of the event is recognized at the point that the monitoring system detects its occurrence."

Page 156. "an event definition is a description of the activity which is to be detected by a monitoring system."

Page 156. "An event definition, is assumed to be a predicate whose operands, or components, are combined or tested using relational, logical or temporal operators."

Page 156. "In order to recognize an event occurrence, data regarding the states of the components must be collected and evaluated."

Page 157. "Associated with each process is a component monitor, which is responsible for detecting changes to the monitored components within that process and, when an alteration occurs to a component, transmitting the value of that alteration to the appropriate event monitor."

Page 162. "When a change occurs to a monitored component in a region, r, which may result in an occurrence of an event, the component's event monitor is informed of the change."

**Claim 40, element b - my analysis of the Spezialetti Reference**

My analysis of this element is the same as my analysis for Claim 1, element b.

**Claim 40, element c - language**

- "Infer occurrence of the event and a context in which the event occurred based at least in part on the detected changes in state,"

**Claim 40, element c - construction**

- “Context” - “information already existing within the system that becomes relevant upon the occurrence of an event”;
- “Inferring” - “logical process by which a factual conclusion is derived from known facts by the application of logical rules”;
- “Inferring . . . a context in which the event occurred” - “logical process by which the fact that information already existing within the system that becomes relevant upon the occurrence of an event is derived by application of logical rules”;
- “Inferring occurrence of an event” - “logical process by which the fact that an event has occurred is derived by application of logical rules”;

My analysis construes the other terms of this element in accordance with their ordinary and customary meaning to one of ordinary skill in the art during the time frame of October 1995.

**Claim 40, element c - analysis by Dr. Cook of the Spezialetti Reference**

Dr. Cook’s analysis of this element is as follows:

Page 155. “One approach to aid in this analysis allows users to describe activity of interest in the form of event definitions. These definitions are predicates which test the states of various system elements. The activity of the elements specified by an event definition is monitored, and data pertaining to their activity collected for analysis. This data is organized into a view of the computation state, and the event definition is evaluated in terms of the states of its operands. An event occurs at the point that the behavior of the computation fulfills the specification of its definition, that is, at the point that the application of the definition's operators to the states of the operands would yield a TRUE result. An occurrence of the event is recognized at the point that the monitoring system detects its occurrence.”

Page 157. “An evaluation monitor may be assigned the task of evaluating an entire event or some portion of an event and is responsible for accumulating and organizing the data which is required to perform the evaluation and potentially make recognitions. . . . [W]henever discussing the assignment of evaluation responsibilities, the module will be referred to as an evaluation monitor, although it may serve as an event monitor as well.”

Page 165. “[A] technique was presented to determine if an immediate recognition of an event’s occurrence could be guaranteed via the placement of evolution monitors based on the characteristics of an event’s operators.”

**Claim 40, element c - my analysis of the Spezialetti Reference**

My analysis of this element is the same as my analysis for Claim 1, element c.

**Claim 40, element d - language**

- "Link the inferred event with an action to be performed during the sales process based on prior sales experience using the sales system, and"

**Claim 40, element d - construction**

- "Inferring" - "logical process by which a factual conclusion is derived from known facts by the application of logical rules";

My analysis construes the other terms of this element in accordance with their ordinary and customary meaning to one of ordinary skill in the art during the time frame of October 1995.

**Claim 40, element d - analysis by Dr. Cook of the Spezialetti Reference**

Dr. Cook did not analyze this element.

**Claim 40, element d - my analysis of the Spezialetti Reference**

The Spezialetti reference does not perform this Claim element: "Link the inferred event with an action to be performed during the sales process based on prior sales experience using the sales system".

The Spezialetti Reference does not describe an "event with an action to be performed during the sales process".

The Spezialetti Reference does not describe how to link events to actions other than for the fixed purpose of viewing monitoring events.

**Claim 40, element e - language**

- "Automatically initiate an operation using one or more of the plurality of subsystems to facilitate the action to be performed based on the inferred context."

**Claim 40, element e - construction**

- "Context" - "information already existing within the system that becomes relevant upon the occurrence of an event";

- "Inferring" - "logical process by which a factual conclusion is derived from known facts by the application of logical rules";
- "Inferring . . . a context in which the event occurred" - "logical process by which the fact that information already existing within the system that becomes relevant upon the occurrence of an event is derived by application of logical rules";
- "Subsystem" - "a system that is part of a larger system";

My analysis construes the other terms of this element in accordance with their ordinary and customary meaning to one of ordinary skill in the art during the time frame of October 1995.

**Claim 40, element e - analysis by Dr. Cook of the Spezialetti Reference**

Dr. Cook did not analyze this element.


**Claim 40, element e - my analysis of the Spezialetti Reference**

The Spezialetti Reference does not link events to operations that can feed information back to other subsystems (except for the fixed purpose of event detections).

## VII. CONCLUSION

As discovery in this matter is continuing, I reserve the right to revise, augment, and supplement my opinions based on my continuing review of relevant materials and the testimony of others.

Should this matter go to trial, I reserve the right to use this report, its exhibits, and documents and information identified herein in support or as a summary of any testimony I may give. In addition, I may use demonstrative devices, including audio or visual aids and schematic representations, animated or otherwise, to illustrate the various technology at issue, or any other technology such as that described in documents referred to herein.

  
Craig W. Thompson, PhD  
4 June 2009

CONFIDENTIAL



**EXHIBIT I: CV OF DR. CRAIG THOMPSON**

## **Craig Warren Thompson**

IEEE Fellow & Professor & Charles Morgan/Axiom Graduate Research Chair in Database  
Computer Science and Computer Engineering Dept., University of Arkansas, Fayetteville  
227 W. 29th Ct., Fayetteville, AR 72701  
cwt@uark.edu, 479-575-6519-office, 479-521-2068-home/fax  
<http://www.csce.uark.edu/~cwt>

### ***Objective***

Computer Science R&D - teaching, publications, proposals, consulting, products, patents, standards, and administration

### ***Education***

Ph.D. in Computer Science, The University of Texas at Austin, May, 1984.

M.A. in Computer Science, The University of Texas at Austin, August, 1977.

B.S. in Mathematics, Stanford University, Palo Alto, California, June 1971.

### ***Research Interests and Experience***

Software architecture, distributed systems, middleware design patterns, service-oriented architectures, semantic web, survivability, quality of service, digital rights, policy languages, change management, incremental algorithms

Database management, data grids, grid indexing, object databases, query languages, spatial databases, synthetic data generation

Artificial intelligence, knowledge representation, agents, ontologies, natural language interfaces

Pervasive computing, virtual worlds, identity management, privacy, RFID middleware, soft controllers, command and control, small unit operations, scenarios, virtual office, virtual enterprise, human factors

### ***General Information***

Status: U.S. Citizen, married, homeowner

Clearance: None at present - had Secret clearance at TI (through ~1995)

Interests: family, travel, hiking, family history, art, reading incl. archaeology, history, scifi

### ***References***

Available upon request

### ***Last updated***

31 January 2009

## **EMPLOYMENT**

***2003-present – Professor and Charles Morgan / Acxiom Graduate Research Chair in Database, Computer Science and Computer Engineering Department, University of Arkansas (\$3M endowed chair). Tenured.***

Research on database, middleware, grid, workflow, agents, virtual worlds, and pervasive computing. Taught undergraduate DBMS, AI, Programming Languages, Software Architectures, Senior Design/Capstone, and graduate DBMS, Advanced Database, AI and Programming Languages plus special projects courses on Agent-based Systems, RFID Middleware, Natural Language Interfaces, and Modeling Healthcare Logistics in a Virtual World. <http://csce.uark.edu/~cwt>

***1995-present – President, Object Services and Consulting, Inc. (OBJ5)***

OBJ5 co-founder with Dr. David Wells and Steve Ford. OBJ5 is a software R&D business focused on executing DARPA and SBIR contracts. Won and executed research contracts, consulted on software architectures for other R&D projects, and developed prescriptive standards. Supervised 3-10 Ph.D. and M.S. OBJ5 is inactive since 2004 but still holds IP. See <http://www.objs.com>

***1981-1995 – Research Manager, Computer Science Lab, Central Research, Development, and Engineering Division, Texas Instruments***

Research Manager, Database Systems Branch, 1990-1995. Supervised: 5-12 exempts, incl. 2-5 Ph.D.s, also 3 summer students, 1 secretary. Directed Zeitgeist OODB and DARPA Open OODB projects.

Research Manager, Multimedia Information Systems Branch, 1988-1989. Supervised: 7 exempts incl. 5 Ph.D.s, also 3 summer students, 1 secretary. Directed Panorama Hypermedia Project and worked on pre-web open hypermedia standards.

Senior Member of Technical Staff, 1985-1988. Only 7% of TI technical staff can be SMTS. Team leader for 3 exempts incl. 2 Ph.D.s, also 2 summer students. Developed OODB and engineering DBMS concepts.

Member of Technical Staff, 1981-1984. Developed NLMenu natural language I/F and RTMS DBMS products.

***1994 Spring – Faculty Associate, Department of Computer Science and Engineering, The University of Texas, Arlington, Texas.***

Team-taught graduate database course with Dr. David Wells.

***1977-1981 – Lecturer, Department of Computer Science, The University of Tennessee, Knoxville, Tennessee.***

Taught senior/graduate courses in database management and artificial intelligence. Taught undergraduate courses in structured programming, numerical analysis, and data structures.

Member, Graduate Admissions Committee and Undergraduate Studies Committee. Directed 22 teaching assistants. Advisor for two M.S. theses.

*1971-1977 - Instructor, Research Assistant, and Teaching Assistant, Department of Computer Science, The University of Texas, Austin, Texas (and at The University of Texas at San Antonio in 1975).*

Taught courses in structured programming, assembly language programming, and data structures. Research on computational linguistics.

*1967, 1969, 1972, 1973 Summers - Senior Programmer and Systems Analyst, Control Data Corporation; U. S. Naval Post Graduate School; and Mellonics, Inc., Division of Litton; all in Monterey, California.*

Wrote programs to monitor CDC 6500 peripheral processor resource usage; worked on terrain map data, submarine sonar detection, and encoding oceanographic measurement data.

## **TEACHING**

Courses Taught at University of Arkansas, Fall 2003 - present

- Database Management - undergraduate, graduate
- Advanced Database - graduate
- Artificial Intelligence - undergraduate, graduate
- Programming Languages - undergraduate, graduate
- Software Architecture - undergraduate, graduate
- Senior Design and Capstone: projects course for all seniors in the CSCE Department
- Special Projects Courses: Agent Systems, RFID Middleware, Natural Language Interfaces, Modeling Healthcare Logistics in a Virtual World - undergraduate, graduate

Course Taught at The University of Texas at Dallas as Adjunct, Spring 1994

- Database Management, graduate level

Courses Taught at University of Tennessee as Instructor, Fall 1977 - Spring 1981

- Artificial Intelligence, senior and graduate level, Fall 1977 - Spring 1981, once a year
- Database Management, senior and graduate level, Fall 1977 - Spring 1981, once a year - grew to be a large class, around 60 students
- Numerical Analysis for Engineers (Intro to programming in Fortran as well as intro to numerical analysis) - 1980-1981
- Structured Programming in PL/C - every semester, 1977-1980

Courses taught at The University of Texas at San Antonio, Texas, 1975 - 1976

- Introduction to Programming

Courses taught at The University of Texas, Austin, Fall 1971 - Spring 1974

- Intro to Programming Lab, GRA
- Assembly Programming, GRA and Instructor - around 60-70 students
- Data Structures, Instructor

## RESEARCH

### Publications (\* = student co-author)

#### Book Chapters

Thompson, Craig and Fran Hagstrom, "Modeling Healthcare Logistics in a Virtual World," In: Lakhmi C. Jain (ed.), *Computational Intelligence in Healthcare* (tentative title), Publisher: Springer-Verlag, Germany, 2009. Invited, not yet published.

Hoag, Joseph E., Craig W. Thompson, "A Parallel General-Purpose Synthetic Data Generator," Editors: Yupo Chan, John Talburt, *Data Engineering: Mining, Information and Intelligence*, Springer-Verlag, 2008.

Thompson, Craig, "The Changing Database Standards Landscape," In: Won Kim (ed), *Modern Database Systems: The Object Model, Interoperability, and Beyond*, Addison Wesley/ACM Press, 1995.

Wells, David, José Blakeley, and Craig Thompson. "The Open Object-Oriented Database: Obtaining Database Functionality by Extension," In: D. Rine and B. Bhargava (eds.), *Readings in Object-Oriented Systems and Applications*, IEEE Computer Society Press, 1994.

Thompson, Craig, "Open OODB," In: R.G.G. Cattell (ed), *Object Data Management: Object-Oriented and Extended Relational Database Management Systems*, Addison-Wesley, 1994.

Chen, John, Tom Ekberg, and Craig Thompson, "Querying an Object-Oriented Hypermedia System," In: R. McAleese and C. Green (ed), *Hypertext: State of the Art*, Ablex Publishing Corporation, 1990. Based on a paper for *Hypertext 2 Conference*, Alvey HCI, University of York, June 29-30, 1989.

#### Journal Papers

Hoag, Joseph, Craig W. Thompson, "A Parallel General-Purpose Synthetic Data Generator," Submitted to *Sigmod Record*, March 2007.

Allsopp, David, Patrick Beaument, Jeff Bradshaw, Ed Durfee, Michael Kirton, Craig Knoblock, Nuranjan Suri, Austin Tate, and Craig Thompson. "Coalition Agents Experiment: Multi-Agent Co-operation in an International Coalition Setting", *IEEE Intelligent Systems*, Special Issue on Knowledge Systems for Coalition Operations (KSCO), Vol. 17, No. 3, May-June 2002,

Thompson, Craig, Paul Pazandak, Venu Vasudevan, Frank Manola, Mark Palmer, Gil Hansen, Tom Bannon, "Intermediary Architecture: Interposing Middleware Object Services between Web Client and Server," *ACM Computing Surveys*, Special Issue on Intelligent Collaboration and Visualization, Vol. 31, No. 2, March 1999.

Thompson, Craig, "Reference Model on Object Information Management," *International Journal of Computer Standards and Interfaces*, Vol. 15, No 2-3, July 1993. My role: I was editor for this X3 reference architecture and wrote much of it based on standards meeting discussions.

Blakeley, José, Craig Thompson, and Abdulah Alashqur. "Strawman Reference Model for Object Query Languages." *International Journal of Computer Standards and Interfaces*, October, 1991.

Joseph, John, Mark Shadowens, Craig Thompson, and John Chen. "Strawman Reference Model for Change Management of Objects." *International Journal of Computer Standards and Interfaces*, October, 1991.

Wells, David, José Blakeley, Craig Thompson. "Architecture of an Open Object-Oriented Database Management System," *IEEE Computer*, Special Issue on Object-Oriented Computing, October, 1992, pp. 74-82.. My role: my 1989 technical report that this paper expands influenced Object Management Group's object management architecture, the world's first service-oriented architecture, a vanguard of today's middleware industry.

Joseph, John, Satish Thatte, Craig Thompson, and David Wells. "Object-Oriented Databases: Design and Implementation," *Proceedings of the IEEE*, Vol. 79, No. 1, January, 1991.

Tennant, Harry, Roger Bate, Steve Corey, Dave Davis, Paul Kline, Lamot Oren, M. Rajinikanth, Rick Saenz, Dan Stenger, Craig Thompson. "Software Innovations for the Texas Instruments Explorer Computer," *Proceedings of the IEEE*, Vol. 73, No. 12, December, 1985, pp. 1771-1790. My role: I wrote sections on three innovative products I developed for the Texas Instruments Explorer Lisp Machine: the Relational Table Management System (RTMS, arguably the first object-oriented database), the Menu-based Natural Language Interface System (NLMenu), and the Tree Editor, a utility.

### ***Magazine Papers***

My *IEEE Internet Computing* magazine column appears three times annually. It was invited because I am an international expert in middleware architectures. My column was rated third among features and top among columns in a reader survey in 2006. *IEEE Internet Computing* is the journal with the second highest IEEE circulation, around 5000, and a very high impact factor (2.55 citations per paper, the measure of the frequency with which the "average article" in a journal has been cited in a particular year calculated by dividing the number of current year citations by the source items published in that journal during the previous two years).

Thompson, Craig and Fran Hagstrom, "Modeling Healthcare Logistics in a Virtual World," Architectural Perspectives column, *IEEE Internet Computing*, September-October, 2008, pp. 100-104.

Eno\*, Josh and Craig Thompson, "Generating Synthetic Data to Match Data Mining Patterns," Architectural Perspectives column, *IEEE Internet Computing*, May-June 2008, pp. 78-82.

Hendaoui\*, Adel, Moez Limayem, Craig Thompson, "3D Social Virtual Worlds: Research Issues and Challenges," Architectural Perspectives column, *IEEE Internet Computing*, Jan-Feb 2008, pp. 88-92.

Reddy\*, Vinitha, Kyle Neumeier\*, Joshua McFarlane\*, Jackson Cothren, Craig Thompson, "Extending a Natural Language Interface with Geospatial Queries," Architectural Perspectives column, *IEEE Internet Computing*, Nov-Dec, 2007, pp. 82-85.

Thompson, Craig, and Dale Thompson, "Identity Management," Architectural Perspectives column, *IEEE Internet Computing*, May-June, 2007, pp. 82-85.

Thompson, Craig, Wing Ning Li, and Zhichun Xiao, "Workflow Planning on a Grid," Architectural Perspectives column, *IEEE Internet Computing*, January-February, 2007, pp. 74-77.

Hoag\*, Joe and Craig Thompson, "Architecting RFID Middleware," Architectural Perspectives column, *IEEE Internet Computing*, September-October, 2006, pp. 88-92.

Thompson, Craig, "Towards a Grid-based DBMS," Architectural Perspective column, *IEEE Internet Computing*, March-April 2006, pp. 87-90.

Thompson, Craig and Rishikesh Jena. "Digital Licensing Services," Architectural Perspective Column, *IEEE Internet Computing*, Volume 9, Number 4, July-August 2005, pp. 85-88.

Thompson, Craig, Paul Pazandak, and Harry Tennant. "Talk to your Semantic Web," Architectural Perspective Column, *IEEE Internet Computing*, May-June 2005, pp. 75-78.

Thompson, Craig, "Smart Devices and Soft Controllers," Architectural Perspective Column, *IEEE Internet Computing*, Volume 9, Number 1, January-February 2005, pp. 82-85.

Thompson, Craig, "Agents, Grids, and Middleware," Architectural Perspective Column, *IEEE Internet Computing*, Volume 8, Number 5, September-October 2004, pp. 97-99.

Thompson, Craig and Pat Parkerson, "DBMS[me]," Architectural Perspective Column, *IEEE Internet Computing*, May-June 2004, pp. 85-89.

Thompson, Craig, "Everything is Alive," Architectural Perspective Column, *IEEE Internet Computing*, January-February 2004, pp. 83-86. Sidebar: "About the Architectural Perspectives Column," *IEEE Internet Computing*, January-February, 2004, pp. 83-86.

### ***Editor of Special Issues***

Roussos, George, Sastry Duri, and Craig Thompson, Co- Guest Editors, "RFID meets the Internet: Middleware, Services, Overlays and the Network Edge," Special Issue of *IEEE Internet Computing*, January 2009. Co-authored Call for Papers, reviewed papers, co-authored Guest Editor Introduction (GEI).

Sharad Mehrotra, Taieb Znati, Craig Thompson, "Crisis Management," Guest Editor Introduction, Special Issue on Crisis Management, *IEEE Internet Computing*, January-February 2008. Provided guidance for Sharad, reviewed and read all accepted papers, co-authored GEI.

Thompson, Craig and David Korsmeyer. "Guest Editor's Introduction," Special Issue on Internet Access to Scientific Data, *IEEE Internet Computing*, Volume 9, Number 1, January-February 2005, pp. 17-19. Co-authored Call for Papers, received 8 papers, assigned reviewers, provided reviews, accepted three papers, drafted the article and Korsmeyer lightly revised. Korsmeyer is Chief, Computational Science Division, NASA Ames.

Thompson, Craig (Guest Editor). "Editor's Introduction," *International Journal of Computer Standards and Interfaces*, Special Issue on OODB Standardization, October, 1991.

### ***Conference and Workshop Papers***

Thompson, Dale, Jia Di, Michael K. Daugherty, Craig W. Thompson, Anthony D. Lofton, Kok Liou and Senthilkumar Chinnappa Gounder Periaswamy, "RFID Information Systems Security Education - Preliminary Results," submitted to *International IEEE Conference on RFID*, Orlando, April 27-28, 2009.

Phillips, Reid, Wingning Li, Craig Thompson, Jonathan Loghry, and David Nash, "Layout Inference: Using Content Type Domains to Infer Record Structure," *Conference on Applied Research in Information Technology*, Acxiom Laboratory for Applied Research, Conway AR, February 13, 2009

Deneke, Wesley, Wingning Li, Craig Thompson, David Nash, Jeffrey Stires, "Towards a Domain-Specific Modeling Language (DSML) for Workflow Specification - Intent Interface and Future

Directions," *Conference on Applied Research in Information Technology*, Acxiom Laboratory for Applied Research, Conway AR, February 13, 2009

Eno, Josh, Craig Thompson, Susan Gauch, "A Virtual World Social Network Crawler," *Conference on Applied Research in Information Technology*, Acxiom Laboratory for Applied Research, Conway AR, February 13, 2009

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Deneke, Wesley, Josh Eno, Wingning Li, Craig Thompson, John Talburt, David Nash, Jeff Stires, Jonathan Loghry, "Towards a Domain-Specific Modeling Language for Customer Data Integration Workflow," *Third International Workshop on Workflow Management and Applications in Grid Environments (WaGe08)*, Kunming, China, May 25-28, 2008.

Eno, Josh, Craig Thompson, Wing Ning Li, Wesley Deneke, "Enhanced Workflow Service Modeling," *2008 Conference on Applied Research in Information Technology*, Acxiom Laboratory for Applied Research, Conway AR, March 14, 2008.

Deneke, Wesley, Josh Eno, Wingning Li, Craig Thompson, John Talburt, David Nash, Jeff Stires, Jonathan Loghry, "Towards a Domain-Specific Modeling Language (DSML) for Customer Data Integration (CDI)," *2008 Conference on Applied Research in Information Technology*, Acxiom Laboratory for Applied Research, Conway AR, March 14, 2008.

Deneke, Wesley, Josh Eno, Wingning Li, Craig Thompson, John Talburt, David Nash, Jeff Stires, Jonathan Loghry, "Towards a Domain-Specific Modeling Language for Customer Data Integration Workflow," *Third International Workshop on Workflow Management and Applications in Grid Environments (WaGe08)*, Kunming, China, May 25-28, 2008.

Phillips, Reid, Patrick Benham, Wing-Ning Li, Gordon Beavers, Craig W. Thompson, Jonathan Loghry, "A Content-Oracle Based Approach for Automating Text File Layout Inference," *2008 Conference on Applied Research in Information Technology*, Acxiom Laboratory for Applied Research, Conway AR, March 14, 2008.

Phillips, Reid, Patrick Benham, Wing-Ning Li, Gordon Beavers, Craig W. Thompson, "A Statistical and Combinatorial Approach to Text File Layout Inference," *2008 Mid-South Conference, Consortium for Computing Sciences In Colleges (CCSC)*, Arkansas Tech University, Russellville, Arkansas, April 4-5, 2008. Republished in *The Journal of Computing Sciences in Colleges*, Volume 23, Number 4, April 2008, pp 43-50.

Phillips, Reid, Patrick Benham, Wing-Ning Li, Gordon Beavers, Craig W. Thompson, "Automating File Schema Recognition Via Content-Based Oracles," *2008 International Conference on Information and Knowledge Engineering (IKE'08 - part of WORLDCOMP'08 Congress)*, Las Vegas, July 14-17, 2008.

Neumeier, Kyle, Craig Thompson, "Parameterizing Menu Based Natural Language Interfaces with Location Models," *IEEE International Conference on Integration of Knowledge Intensive Multi-Agent Systems (KIMAS-07)*, Waltham, MA, April 18-21 2007.



- Hoag, Joseph, Reid Phillips, Craig Thompson, Ray Huetter, John Veizades, "SensorConnect Performance and Scalability Experiments," *First IEEE International Conference on RFID*, Grapevine, TX, March 26-28, 2007, pp. 121-126.
- Phillips, Reid, John Allison, Craig Thompson, "Subsetting the Workflow Grid," Submitted to *Conference on Applied Research in Information Technology*, Acxiom Laboratory for Applied Research, Conway AR, March 9, 2007.
- Hoag, Joseph, Craig Thompson, "Applications of Synthetic Data Generation," *Conference on Applied Research in Information Technology*, Acxiom Laboratory for Applied Research, Conway AR, March 9, 2007.
- Thompson, Craig, "Architecting Secure Identity Solutions," *Symposium & Workshop on Identity Solutions*, Arkansas State University, Jonesboro, Arkansas, February 21 and 22, 2007.
- Neumeier, Kyle, Craig Thompson, "Dynamic Composition of Agent Grammars," *Proceedings of the Second IASTED International Conference on Computational Intelligence*, San Francisco CA, November 20-22 2006.
- Xiao, Zhichun, Craig Thompson, Wingning Li, "Data Processing Workflow Automation in Grid Architecture," *Fifth International Conference on Grid and Cooperative Computing - Workshops: International Workshop on Workflow Systems in Grid Environments (WSGE06)*, Changsha, China, October 21-23, 2006, p. 189-195.
- Xiao, Zhichun, Craig Thompson, Wingning Li, "Automating Workflow for Data Processing in Grid Architecture," *International Conference on Information and Knowledge Engineering (IKE'06)*, Las Vegas, Nevada, June 26-29, 2006, p. 191-195.
- Thompson, Dale, Jia Di, and Craig Thompson, "Categorizing RFID Privacy Threats with STRIDE", Poster, *Symposium On Usable Privacy and Security*, Pittsburgh, PA, July 12-14, 2006
- Thompson, Dale, N. Chaudhry, Craig Thompson, "RFID Security," *Proceedings of the Acxiom Laboratory for Applied Research Conference*, Conway, AR, March 3, 2005, Conway AR. (refereed 8.6/10)
- Hoag, Joseph and Craig Thompson, "RFID Agent Middleware Architecture," *Conference on Applied Research in Information Technology*, Conway, AR, March 3, 2006. Open source.
- Thompson, Craig and Reid Phillips, "Smart Grid/Agent Capability Architecture," *First International Workshop on Smart Grid Technologies*, held at the *Fourth International Joint Conference on Autonomous Agents and Multiagent Systems (AAMAS 2005)*, July 25 - 29, 2005, Utrecht, Netherlands.
- Crisp, Robert and Craig Thompson, "Everything is Alive (EiA): a Macro Framework for the Future," *Internet, Processing, Systems, and Interdisciplinary Research (IPSI) Conference*, Spain, April 28-May 1, 2005.
- Allen, Jared, Duong, Quang and Craig Thompson. "Natural Language Service for Controlling Robots and Other Agents," *2005 International Conference on Integration of Knowledge Intensive Multi-Agent Systems*, IEEE, April 18-21, 2005. pp. 592-595.
- Caloianu, Ciprian and Craig Thompson. "Digital Rights for Agents," *2005 International Conference on Integration of Knowledge Intensive Multi-Agent Systems*, IEEE, April 18-21, 2005. pp. 492-496.

- Jena, Rishikesh and Craig Thompson. "Licensing Service for Agents," *2005 International Conference on Integration of Knowledge Intensive Multi-Agent Systems*, IEEE, April 18-21, 2005. pp. 418-421.
- Robertson, Joseph and Craig Thompson. "EiA Agent Architecture," *2005 International Conference on Integration of Knowledge Intensive Multi-Agent Systems*, IEEE, April 18-21, 2005. pp. 21-25.
- Vu, Minh and Craig Thompson. "E2 Agent Plugin Architecture," *2005 International Conference on Integration of Knowledge Intensive Multi-Agent Systems*, IEEE, April 18-21, 2005. pp. 26-31.
- Thompson, Craig, "Towards a Grid-based DBMS," *Conference on Applied Research in Information Technology*, Acxiom Laboratory for Applied Research (ALAR), Conway, AR, February, 2005.
- Brown, Barbara, Paul Morris, and Craig Thompson, "SUO Communicator: Agent-based Support for Small Unit Operations," *IEEE Integration of Knowledge Intensive Multi-Agent Systems (KIMAS)*, Cambridge, MA, October 1-3, 2003.
- Allsopp, David, Patrick Beaument, Jeff Bradshaw, Ed Durfee, Michael Kirton, Craig Knoblock, Nuranjan Suri, Austin Tate, and Craig Thompson. "Coalition Agents Experiment: Multi-Agent Co-operation in an International Coalition Setting", *Proceedings of the Second International Conference on Knowledge Systems for Coalition Operations (KSCO-2002)*, Toulouse, France, 23-24 April 2002.
- Wells, David, Steve Ford, Craig Thompson, and Tom Bannon. "Msg\*Log: E-mail Based Agent Messaging to Improve Robustness in a Distributed Logistics Planner," *Software Technology Conference*, Salt Lake City, May 2, 2001. Re-published in *The DoD Software Tech News Newsletter*, Special Issue on Software Agents Part I, Vol. 4, No. 4, October 2001.
- Thompson, Craig, Tom Bannon, Paul Pazandak, and Venu Vasudevan. "Agents for the Masses," invited paper, *Agent99 Workshop on Agent-Based High Performance Computing: Problem Solving Applications And Practical Deployment*, Seattle, May 1 1999.
- Thompson, Craig, Paul Pazandak, Venu Vasudevan, Frank Manola, Mark Palmer, Gil Hansen, Steve Ford. "Intermediary Architecture: Interposing middleware services and ilities between web client and server," *OMG-DARPA Workshop on Compositional Architectures*, Monterey, January 6-8, 1998.
- Thompson, Craig. "Virtual Enterprises Require OMA/WWW Integration," *W3C-OMG Workshop on Distributed Objects and Mobile Code*, Boston, June 24-25, 1996.
- Thompson, Craig. "Open Research Issues in Object Services Architectures (OSAs)," *First International Workshop on Software Architectures*, Seattle, WA, April 1995, held in conjunction with *International Conference on Software Engineering*.
- Thompson, Craig. "Open Research Issues in Object Services Architectures (OSAs)," *Report on DARPA Persistent Object Base Workshop*, Breakout session on OSAs, La Jolla, CA, November 1994.
- Hodges, Robert and Craig Thompson. Position Paper, *OOPSLA Workshop on Multi-Language Object Models*, Portland, Oregon, 23 October 1994. Hodges was principal author and presenter.
- Wells, David, Craig Thompson, José Blakeley. "DARPA Open Object-Oriented Database System," *Proceedings of the DARPA Software Technology Conference*, Los Angeles, CA, April 28-30, 1992. Paper was based on my earlier technical report and Wells' subsequent extensions.
- Alashqur, Abdulah and Craig Thompson. "O-R Gateway: A System for Connecting C++ Application Programs and Relational Databases," *Usenix C++ Conference*, 1992.

ESPRIT: Francois Bancilhon, Stephano Ceri, Rick Morrison, F. Rabitti, J. Schmidt, S. Bensasson; U. S.: Peter Buneman, David DeWitt, Rick Hull, Roger King, David Maier, Craig Thompson, Stan Zdonik, Brian Boesch (DARPA), E. Mettala (DARPA), M. Zemankova (NSF). "Next Generation Databases," *DARPA, NSF, ESPRIT Joint Exploratory Workshop on Information Science and Technology*, July 23-26, 1990, published: May 1991. Workshop focused on identifying opportunities for US/EC Collaboration in Information Technology. Contributor.

Thompson, Craig and José Blakeley. "Cost Model for DSSA-based Software Evolution," Position Paper, *DARPA Workshop on Domain Specific Software Architectures*, July 1990.

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Thompson, Craig, John Chen, Rusty Lewis, Steve Corey, and Steve Martin. "CommonTools Hypermedia Environment," *Hypertext '87*, University of North Carolina, Chapel Hill, November 11-13, 1987.

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Thompson, Craig, Steve Corey, M. Rajinikanth, Prasanta Bose, Steve Martin, Rajiv Enand, R. Roberts, Rusty Lewis, and Sang Cha. "RTMS: Toward Close Integration between Database and Application," *Hawaii International Conference on System Sciences*, Kailua-Kona, Hawaii, January 6-9, 1987.

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Enand, Rajiv and Craig Thompson. "Toward a Real-Time Data Model," *International Industrial Controls Conference/Controls West*, Long Beach, CA, September 16-18, 1985.

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Thompson, Craig and Steve Martin. "Asking Map- and Graph-Valued Queries Using a Menu-Based Natural Language Interface," *ACM Annual Conference*, Denver, Colorado, October 14-16, 1985.

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Stern, Bruce, Bruce Anderson, and Craig Thompson. "A Menu-Based Natural Language Interface to a Large Database," *NAECON: National Aerospace and Electronics Conference*, Dayton, Ohio, May 20-24, 1985.

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Tennant, Harry, Ken Ross, and Craig Thompson. "Usable Natural Language Interfaces Through Menu-Based Natural Language Understanding," *Proceedings of the Conference on Human Factors in Computing Systems*, Boston, MA, December, 1983.

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Harry Tennant, Ken Ross, Rick Saenz, James Miller, and Craig Thompson. "Menu-Based Natural Language Understanding," *Proceedings of the 21st Meeting of the Association for Computational Linguistics (ACL)*, MIT, June, 1983.

Hendrix, Gary, Jonathan Slocum, and Craig Thompson. "Language Processing via Canonical Verbs and Semantic Models," *Proceedings of the Third International Joint Conference on Artificial Intelligence (IJCAI)*, Stanford University, August, 1973.

#### ***Texas Instruments Engineering Journal***

R. Hewes, S. Thatte, C. Thompson, P. Yang, K. Hutchinson, B. Hatzell, S. Gupta. "CRD&E CAD/CAM Programs," *Texas Instruments Technical Journal*, Vol. 4, No 3, May-June 1987.

C. Thompson. "Object-Oriented Databases," *Texas Instruments Engineering Journal*, Vol. 3, No. 1, January-February, 1986.

C. Thompson. "Building Menu-Based Natural Language Interfaces," *Texas Instruments Engineering Journal*, vol. 3, no 1, January-February, 1986.

#### ***My Dissertation and Masters Thesis***

Thompson, Craig. "Using Menu-Based Natural Language Understanding to Avoid Problems Associated with Traditional Natural Language Interfaces to Databases," Ph.D. Dissertation, Department of Computer Science, The University of Texas, Austin, Texas, June, 1984. Advisor: Dr. Robert Simmons.

Thompson, Craig. "Question Answering via Canonical Verbs and Semantic Models: Parsing to Canonical Verb Forms," M.A. Thesis, TR-11, Department of Computer Science, The University of Texas, Austin, Texas, August, 1977. Led to IJCAI paper.

***Other technical reports***

Manola, Frank and Craig Thompson. "Characterizing the Agent Grid," Invited for: J. Bradshaw (ed), *Handbook of Agent Technology*, AAAI Press/MIT Press, prepared but book *never published*.

Thompson, Craig, "SUR: A Single User Relational Database Management System," CS-80-45, Technical Report, Department of Computer Science, The University of Tennessee, Knoxville, August, 1980. Design for a PC-based relational DBMS, implemented as a class project. Updated for CSCE DBMS courses, 2004.

***Formal and technical reports for standards bodies*****Object Management Group - general - 1990-2002**

Thompson, Craig, T. Linden, R. Filman, "Thoughts on OMA-NG: The Next Generation Object Management Architecture," an OMG green paper (architecture paper) presented to OMG Object Model and Reference Model Subcommittee (ORMSC) in September 1997 as an important step toward the first major revision of the OMG OMA in eight years. The paper describes limitations of the current OMA architecture (what it does not explain) and suggests extensions in the areas of fundamental concepts, dispatch mechanisms, composition/containment model, federation, -ilities, packaging, interoperation, and the economy of componentware. Several of the suggestions were adopted into the ORMSC green paper.

Thompson, Craig, Stanley Su. "Rule Management Facility," in *OMG Common Facilities Architecture*, Dec 1994, 1996. Led to Thompson, Craig, "Event-Condition-Action Rules Facility," draft OMG Common Facilities RFP, June 1996. Presented in Madrid to the Common Facilities and Architecture Board, July 1996. RFP never issued, no agreement in OMG over kind of rules are needed.

Thompson, Craig, José Blakeley and David Wells, "Object Query Service," OMG Documents 09-44, September, 1994. Specification submitted to OMG Object Services Task Force RFP#4. Specification includes OQL[IDL] and OQL[C++]. The goal was to unify SQL3, ODMG, and OMG approaches to querying. ODMG won this battle but their spec was never implemented.

Thompson, Craig, et. al., "Query Language: Object-Oriented Query Language and Extensions to SQL," Section 6, Workshop on Objects in Data Management, *Proceedings of the Third Joint Meeting in Anaheim, California*, sponsored by X3/SPARC Database Systems Study Group, 1992.

Thompson, Craig (editor). *OMG Object Services Architecture*, Versions 3.0-6.0, OMG document 92-08-04, Object Management Group, 1992 (72 pages). Widely circulated in industry. Document formed the basis for a series of OMG Object Services Task Force RFPs resulting in the COSS-1, COSS-2, COSS-3, and COSS-4 specifications (aka CORBAServices). Provided the blueprint for the middleware industry; predecessor to today's web services.

Thompson, Craig, "Position Paper: Choice of Object Model for OMG - Concepts for the Ubiquitous Object Model (UOM)," OMG Document 1991/91-05-01, submitted in response to OMG Object Model Task Force Request for Information (OMG Document 91-01-11), May 1991. Recommends that OMG accept multiple object models, not develop YAOM (yet-another-object-model). Instead, they developed IDL and bundled in distribution to form the CORBA specification. The two specifications should have been separated.

Thompson, Craig, "Response to the Object Services RFI" (OMG Document 1992/92-02-18) and "DARPA Open OODB System General Overview" (OMG Document 92-02-19) submitted in response

to OMG Object Services Task Force Request for Information (OMG Document 1991/91-11-06). Our submission described a services architecture. Most of the Open OODB services (events, externalization, persistence, transactions, queries, change management) are now part of the "OMG Object Services Architecture" as are the architecture principles we contributed, which are now part of every OMG RFP.

William Andreas, Goeff Lewis, Matthew Mathews, Lee Scheffler, R. Soley, Craig Thompson, "Reference Model," *Object Management Architecture Guide*, Object Management Group document 1990/90-09-01. Known as the OMA Guide, this document was the OMG Bible in the 1990s, widely circulated in industry, providing the basic architecture for OMG (CORBA backplane plus object services). Industry's first service-oriented middleware architecture. Appears as a chapter in a James Martin book on object-oriented technology.

Thompson, Craig, José Blakeley, Tom Bannon, John Chen, Tom Ekberg, Steve Ford, Anil Gupta, J. Joseph, Edward Perez, Diana Sparacin, Robert Peterson, Mark Shadowens, Satish Thatte, Chung Wang, David Wells. "Open Architecture for Object-Oriented Database Systems." Texas Instruments Technical Report ITL-89-12-01, Computer Science Center, Texas Instruments, December 1989. OMG document 1990/90-01-06. I authored this document. It was presented at third meeting of OMG in January 1990 in New York City before there was an OMG architecture. It describes a componentized database architecture using an object bus with services hanging off the bus. Drafts of this report provided key ideas for the DARPA Open OODB Phase I contract and directly influenced the *OMG OMA Guide* "Reference Model."

#### OMG - Internet Special Interest Group (ISIG) - 1995-1998

Organized the OMG ISIG which aimed to help unify Internet and Web technology with OMG object technology. Co-chaired with Shel Sutton (MITRE). Arranging for speakers and agendas, led meetings, completed the minutes, and maintained the homepage - see <http://www.objs.com/isig/home.htm>. ISIG accomplishments:

RFI and RFPs - As a result of OMG Internet SIG's RFI recommendations, the OMG Common Facilities and ORBOS Task Forces redirected some of their efforts to Internet-related RFPs including Common Internet Protocols, Java-to-IDL (Java Reverse Mapping), Firewalls, Component Model, Scripting Language.

Working groups - ISIG was home to several active working groups: Compositional Software Architectures, Agents (prior to Agent SIG), Computer Supported Cooperative Work, Web-OMA Integration Architectures, Object Transfer and Manipulation Facility.

My contributions:

Thompson, Craig, Mission Statement, Sep 1995.

Thompson, Craig, Agendas and Minutes of Meetings #1-32.

Thompson, Craig, Internet Engineering Task Force (IETF) Trip Report (and IETF's Relationship to OMG), OMG Internet SIG document internet/96-01-06.

Thompson, Craig, OMG Internet Services Request for Information, OMG ORBOS Task Force, OMG document orbos/96-06-18, June 1996.

Thompson, Craig, Response from Object Services and Consulting, Inc. to the OMG Internet Services RFI, October, 1996.

Thompson, Craig, Final Recommendations and Roadmap re OMG Internet Services RFI, March 1997.

Thompson, Craig, Workshop presentation: "OMG Internet SIG," OOPSLA Workshop: Toward the integration of WWW and Distributed Object Technology, OOPSLA, 1996. Overview of OMG Internet SIG.

#### OMG - Agent Special Interest Group - 1998-2001

Organized the OMG Agent Working Group which aims to identify how to unify agent and object middleware technologies. Co-chaired with Jim Odell, Francis McCabe, and Steve McConnell and maintained OMG Agent Working Group Homepage. Agent SIG accomplishments:

RFI and RFPs - As a result of OMG Internet SIG's RFI recommendations, the OMG Common Facilities and ORBOS Task Forces redirected some of their efforts to Internet-related RFPs including Common Internet Protocols, Java-to-IDL (Java Reverse Mapping), Firewalls, Component Model, Scripting Language.

Working groups - ISIG was home to several active working groups: Compositional Software Architectures, Agents (prior to Agent SIG), Computer Supported Cooperative Work, Web-OMA Integration Architectures, Object Transfer and Manipulation Facility.

My contributions:

Thompson, Craig, Mission Statement.

Thompson, Craig, Agendas and Minutes of Meetings #1-17, see <http://www.objs.com/agent/index.html>

Thompson, Craig, OMG-FIPA Liaison Agreement.

Thompson, Craig, *OMG Agent Technology Request for Information*.

Thompson, Craig, Characterizing the Agent Grid, Response from OBJS to the OMG Agent Technology RFI, August, 1999.

Thompson, Craig, Agent Discovery and Registration Service, Technical Note, OMG, Phoenix, NM, Jan 10-11, 2000.

J. Odell, Craig Thompson, other contributors. *OMG Agent Technology Architecture*, Contributed sections on architecture, grid, system-wide properties, and object-agent mapping, 2001. Odell was editor. I contributed sections.

Thompson, Craig, Agent Glossary, In: *OMG Agent Technology Architecture*.

Thompson, Craig, Agent Technology White Paper and RFP Roadmap, March 14, 2000.

#### DARPA Reference Architecture for Intelligent Information Systems - 1995

Yigal Arens, Richard Hull, Roger King, Muchael Siegel, Hector Garcia-Molina, Michael Genesereth, Art Goldschmidt, Larry Kerschberg, Narinder Singh, Craig Thompson. *DARPA Reference Architecture for Intelligent Information Systems*, June 1995. Contributor.

#### National Industrial Information Infrastructures Protocol Reference Architecture - 1995

Thompson, Craig, David Zenie, Jeff Pan, Martin Hardwick. *National Industrial Information Infrastructures Protocol Reference Architecture: Concepts and Guidelines*, NIIIP Consortium, January 1995.

Thompson, Craig, Frank Manola, "Descriptive/Prescriptive Glossary of Software Architectural Terms." 1997. One of the first extensive glossaries of componentware terms, covering many issues that NIIIP wrestled with.

#### ANSI X3H7 Technical Committee on Object Information Management - 1992

Thompson, Craig, "Matrix of Object Model Features by Object Model Systems" (initial editor). Also authored "OODBTG Description" in matrix. This work eventually resulted in Frank Manola (ed), NCITS H7 (formerly X3H7) *Object Model Features Matrix*, June 1997.

#### Workshop on Application Integration Architectures

Thompson, Craig, organizer, co-chair with Bob Hodges (TI), and author of the workshop report. *Workshop on Application Integration Architectures*, Dallas, Texas, February 8-12, 1992. Published as NIST Technical Report and also OMG Document 1994/94-1-2.ps. Workshop convened key contributors to key industry standards groups and consortia, including DARPA, Object Management Group, Open System Foundation, X/Open, Portable Common Tools Environment, CAD Framework Initiative, PDES/STEP, EIA/CDIF, DARPA STARS, ECMA NIST Reference Model, ODMG, X3 OODB Task Group, ANSI X3T3 ODP, ANSI X3H2 SQL, ANSI X3H4 IRDS, ANSI X3H6 CASE Integration Models, and ANSI X3H7 Object Information Management. The objective of the workshop was to construct a road map for how the participating organizations can cooperate to realize the shared vision of a common industry-wide integration architecture to guarantee standards produced by these organizations would interoperate.

#### ANSI X3 Database Systems Study Group (DBSSG) Object-Oriented Database Task Group (OODBTG) - 1989-1991

Primary author. E. Fong, W. Kent, K. Moore, Craig Thompson (eds.). *Final Report of the ANSI X3/SPARC/DBSSG Object-Oriented Database Task Group*, August, 1991. Distributed as NIST Technical Report. Also, OMG Document 1989/89-10-02 and later 1992/92-2-05 submitted to OMG by Craig Thompson as a response to the Object Services Task Force RFI, document 91-11-06. Fifty contributors listed. Report covers two years work, characterizes OODBs, and recommends standards in the OODB area. The document was distributed to over 1000 people and influenced ANSI X3, Object Management Group and to a lesser extent ODMG. The Task Group effort led to the formation of ANSI X3H7 Technical Committee on Object Information Management. Significant chapters in Final Report:

Thompson, Craig, A. Otis, W. Kent (ed.). "Reference Model for Object Data Management." Characterizes OODBs as a collection of modular capabilities (now called services); aligned with and influenced by our Open OODB architecture; using a design space methodology I developed; influenced OMG OSA architecture.

Thompson, Craig, W. Kent, K. Moore (eds.). "Recommendations for Standards in the OODB Area." Identifies OODB interfaces that can be standardized, analyzes likelihood of consensus, identifies related standards, provides a guide for OODB standardization.

G. Everest, M. Hanna, Craig Thompson. "Survey of OODB Systems." First detailed survey of OODBs. Also Thompson, Craig et. al., "Open Zeitgeist OODB," TI Response to OODBTG OODB Survey.

Thompson, Craig, "Summary of Workshops on OODB Standardization."



Thompson, Craig, "OODB Glossary," based on my "DARPA Open OODB Glossary" and appeared in a James Martin book.

### ***Conferences and Workshops Organized***

Thompson, Craig, Conference Chair, *Conference on Applied Research in Information Technology*, Axiom Laboratory for Applied Research, March 9, 2007.

Thompson, Craig and Henry Hexmoor (Publication Co-Chairs), *2005 International Conference on Integration of Knowledge Intensive Multi-Agent Systems*, IEEE, April 18-21, 2005. 640 pages.

Thompson, Craig, "Workshop Report," *OMG-DARPA Workshop on Compositional Architectures*, Monterey, January 6-8, 1998. Published in: *ACM SIGSOFT Software Engineering Notes (SEN)*, Vol. 23, No. 3, May 1998. Workshop organizer, drafted call for papers, lined up sponsors, chaired program committee, organized agenda, chaired meeting, edited workshop report. 110 papers submitted. 100 attendees. Purpose of workshop was to discuss object-web architectures and how to insert new behaviors corresponding to system properties (-ilities) into systems.

Thompson, Craig, *W3C-OMG Workshop on Distributed Objects and Mobile Code*, Boston, June 24-25, 1996. Co-organizer w Richard Soley (OMG) and Dan Connolly (W3C), wrote Call for Papers and Program Committee member along with Tim Berners-Lee.

Thompson, Craig, *Workshop on Application Integration Architectures*, Dallas, Texas, February 8-12, 1992. Organizer, co-chair w Bob Hodges, edited workshop report. See Standards.

Thompson, Craig, *DARPA Open OODB Workshops I-IV*, Organizer and workshop reports, 1991-1993. See Contracts.

Thompson, Craig, Industrial Program Chair, *SIGMOD 1991*. Arranged sessions on CALS Product Data Exchange using STEP, CAD frameworks, and object-oriented standards. Successful experiment.

Thompson, Craig, *First Workshop on OODB Standardization*, Atlantic City, NJ, May 22, 1990. Organized workshop, chaired, edited final report as NISTIR 4503, 299 pp. Sponsored by X3 OODB Task Group.

Thompson, Craig, *OOPSLA '88 Object-Oriented Database Workshop*, San Diego, California, 26 September 1988. Co-organizer w S. Thatte and co-authored workshop report which appeared in *SIGMOD Record*, Vol. 18, No. 3, September 1989.

Thompson, Craig, *First Conference on New Directions in Database and Knowledge Management Systems*, IEEE Computer Society, Dallas Chapter, March 1987. Organized, chaired. 40 DFW-area presentations.

### **Presentations, Seminars, Panels, Interviews**

Thompson, Craig plus grad students Josh Eno and undergraduates Casey Bailey, Josh McFarlane, Keith Perkins, and Nick Farrer demoed our "Healthcare Logistics in a Virtual World" project to the RFID Research Center board meeting on June 19, 2008 and December 11, 2008

Thompson, Craig, "Extending Menu-based Natural Language Interfaces with Geospatial Queries," GIS Day, Center for Advanced Spatial Technologies, November 14, 2007.

Thompson, Craig, "Healthcare Logistics in a Virtual World," presentation and demo to Bentonville Rotary Club, November 8, 2008

Interview with Anastasia Poland, To Appear, Computer Power User magazine, October 27, 2008, <http://www.computerpoweruser.com/>

Thompson, Craig plus grad student Josh Eno and undergraduates Casey Bailey, Josh McFarlane, Keith Perkins and Clinton Monk demoed our "Healthcare Logistics in a Virtual World" project to the Center for Innovation in Healthcare Logistics (CIHL) Spring board meeting on May 14, 2008 and Oct 21 2008.

Interview with Beth Bacheldor, "University Students Create a Virtual RFID-Enabled Hospital," ACM Tech News, September 24, 2008, <http://technews.acm.org/archives.cfm?fo=2008-09-sep/sep-24-2008.html#380217>

Thompson, Craig, "Menu-based Natural Language Interfaces," Cognitive Science Lunch, UARK Union, September 19, 2007.

Interview with Beth Bacheldor, "University Students Create a Virtual RFID-enabled Hospital," RFID Journal, September 16, 2008

Interview with Bill Ray, "Big Brother tracking comes to Second Life," The Register, September 17, 2008, [http://www.theregister.co.uk/2008/09/17/second\\_life\\_rfid/print.html](http://www.theregister.co.uk/2008/09/17/second_life_rfid/print.html)

Interview with Laurie Whalen, "Students Track RFID Tracking in Hogspital," Arkansas Democrat Gazette, August 31, 2008, [http://www.nwanews.com/adg/Business\\_Matters/236033/](http://www.nwanews.com/adg/Business_Matters/236033/)

Interview with Matt McGowan, "Modeling Health Care Logistics in a Virtual World," UARK Daily Headlines, Aug 27 2008, <http://dailyheadlines.uark.edu/13327.htm>

Interview with Bryan Edward Rachal II, "Modeling Health Care Logistics in a Virtual World," Ozarks at Large, University of Arkansas KUAF 91.3 FM, aired August 11, 2008, [http://www.publicbroadcasting.net/kuaf/news.newsmain?action=article&ARTICLE\\_ID=1338030](http://www.publicbroadcasting.net/kuaf/news.newsmain?action=article&ARTICLE_ID=1338030)

Thompson, Craig, "Research at UARK in RFID Middleware, Synthetic Data Generation, Menu-based Natural Language, and Grid Indexing," *Microsoft Faculty Summit 2007*, Redmond, WA, July 2007.

Thompson, Craig, Panel on RFID Infrastructure, *IEEE Workshop on Local and Metropolitan Area Networks (LANMAN'07)*, June 10-13, 2007.

Thompson, Craig, "Architecting Secure Identity Solutions," *Symposium & Workshop on Identity Solutions*, Arkansas State University, Jonesboro, Arkansas, February 21 and 22, 2007.

Thompson, Dale, Jia Di, Craig Thompson, "Categorizing RFID Privacy Threats with STRIDE", Poster, *Symposium On Usable Privacy and Security*, Pittsburgh, PA, July 12-14, 2006. The standards group EPCglobal is adopting this STRIDE model due to Dale Thompson's participation in their security subgroup.

Thompson, Craig and Reid Phillips. "Smart Grid/Agent Capability Architecture," First International Workshop on Smart Grid Technologies, held at the *Fourth International Joint Conference on Autonomous Agents and Multiagent Systems (AAMAS 2005)*, July 25 - 29, 2005, Utrecht, Netherlands.

Thompson, Craig, "DBMS on a Grid," Poster Session, *MIDnet Annual Conference, Lighting the Path Across the Great Plains: Networking, Middleware & Grid Computing*, Great Plains Network, Kansas City, MO, June 8-9-10, 2005. Poster presentation.

Thompson, Craig, "RFID Enterprise Integration Architecture," Poster Session, *MIDnet Annual Conference, Lighting the Path Across the Great Plains: Networking, Middleware & Grid Computing*, Great Plains Network, Kansas City, MO, June 8-10, 2005. Poster presentation.

Allen, Jared, Duong, Quang and Craig Thompson. "Natural Language Service for Controlling Robots and Other Agents," *2005 International Conference on Integration of Knowledge Intensive Multi-Agent Systems*, IEEE, April 18-21, 2005. Allen and Quang are my undergraduate honors students.

Caloianu, Ciprian, Rishikesh Jena, and Craig Thompson. "Digital Rights for Agents," *IEEE International Conference on Integration of Knowledge Intensive Multi-Agent Systems*, IEEE, April 18-21, 2005. pp. 492-496. Jena is my graduate student.

Jena, Rishikesh and Craig Thompson. "Licensing Service for Agents," *IEEE International Conference on Integration of Knowledge Intensive Multi-Agent Systems*, IEEE, April 18-21, 2005. pp. 418-421.

Robertson, Joseph and Craig Thompson. "EiA Agent Architecture," *IEEE International Conference on Integration of Knowledge Intensive Multi-Agent Systems*, IEEE, April 18-21, 2005. pp. 21-25. Robertson was my GRA.

Vu, Minh and Craig Thompson. "E2 Agent Plugin Architecture," *IEEE International Conference on Integration of Knowledge Intensive Multi-Agent Systems*, IEEE, April 18-21, 2005. pp. 26-31. Vu was my GRA.

Thompson, Craig, "Towards a Grid-based DBMS," *Proceedings of the Acxiom Laboratory for Applied Research Conference*, February 18, 2005, Conway AR.

Thompson, Craig, W. Li, C. Bayrak, Z. Xiao, "Workflow Automation," *Acxiom Laboratory for Applied Research Conference (ALAR'05)*, University of Central Arkansas, Conway, Arkansas Feb. 18, 2005. PhD candidate Xiao was lead graduate student on this project.

Thompson, Craig, W. Li, C. Bayrak, "A Framework to Automate the Generation of BCDI Process Flows (Topic 3)," *Conference on Applied Research in Information Technology*, Acxiom Laboratory for Applied Research (ALAR), Little Rock, AR, February 27, 2004.

Thompson, Craig, "SUO Communicator: Agent-based Support for Small Unit Operations," *IEEE International Conference on Integration of Knowledge Intensive Multi-Agent Systems*, Cambridge, MA, October 1-3, 2003.

Thompson, Craig, Tom Bannon, Paul Pazandak, and Venu Vasudevan. "Agents for the Masses," invited paper, *Agent99 Workshop on Agent-Based High Performance Computing: Problem Solving Applications And Practical Deployment*, Seattle, May 1 1999.

Thompson, Craig. "Virtual Enterprises Require OMA/WWW Integration," *W3C-OMG Workshop on Distributed Objects and Mobile Code*, Boston, June 24-25, 1996.

Thompson, Craig. "Open Research Issues in Object Services Architectures (OSAs)," *First International Workshop on Software Architectures*, Seattle, WA, April 1995, held in conjunction with *International Conference on Software Engineering*.

Thompson, Craig. "Open Research Issues in Object Services Architectures (OSAs)," *Report on DARPA Persistent Object Base Workshop*, Breakout session on OSAs, La Jolla, CA, November 1994.

Thompson, Craig. "Open OODB and implications for industry/standards," Keynote, *12th International Conference on the Entity-Relationship Approach*, Dallas, Texas, Dec 15-17, 1993.

Thompson, Craig, "Database Challenge: Object-File Systems." *ACM SIGMOD International Conference on Management of Data*, Washington, D. C., May 1993.

Thompson, Craig. "Strawman Reference Model for Hypermedia Systems," In: J. Moline (ed), *Proceedings of the Hypertext Standardization Workshop*, National Institute of Standards and

Technology, January 16-18, 1990. Contribution cited in proceedings introduction. Reprinted in: David Penfold (ed.), *SGML Users' Group Bulletin*.

Thompson, Craig, J. Chen. "A Hypermedia Editor to Support Compound Documents," *Conference on New Directions in Database and Knowledge Management Systems*, IEEE Computer Society, Dallas Chapter, March 22, 1988. Chen reported to me.

Thompson, Craig and Steve Martin. "Using Menu-Based Natural Language to Query an Integrated Database Management and Information Retrieval System," *Second Symposium on Computer Interfaces and Intermediaries for Information Retrieval*, Defense Technical Information Center, Boston, MA, May 28-31, 1986. Author.

Thompson, Craig, "Menu-Based Natural Language Interfaces to Databases," invited for: *Database/86 Symposium*, Berkeley, California, August 4-8, 1986. Organizer: Michael Stonebraker.

Thompson, Craig, M. Stonebraker, others. Panel: "Whither User Interfaces and Database Applications," *Database/86 Symposium*, Berkeley, California, August 4-8, 1986.

Thompson, Craig, "Object-Oriented Databases," invited for: *First Annual Rocky Mountain Conference on Artificial Intelligence*, University of Colorado, Boulder, CO, June 13-14, 1986.

Thompson, Craig, John Kolts, and Ken Ross. "A Toolkit for Building Menu-Based Natural Language Interfaces," *ACM Annual Conference*, Denver, Colorado, October 14-16, 1985.

Thompson, Craig and Steve Martin. "Asking Map- and Graph-Valued Queries Using a Menu-Based Natural Language Interface," *ACM Annual Conference*, Denver, Colorado, October 14-16, 1985.

Thompson, Craig, "Intelligent Machines and Human Computer Interfaces: Prospects for More Useful Machines," panel at: *First Annual Rocky Mountain Conference on Artificial Intelligence*, University of Colorado, Boulder, CO, June 13-14, 1986.

Thompson, Craig, "Menu-Based Natural Language Interfaces To Databases," invited for: *Database/85 Symposium*, Berkeley, California, July 29-August 2, 1985.

Thompson, Craig. "Recognizing Values in Queries or Commands in a Natural Language Interface to Databases," *First Conference on Artificial Intelligence Applications*, Denver, December, 1984.

Thompson, Craig. "Object-Oriented Text Generation," *First Conference on Artificial Intelligence Applications*, Denver, December, 1984.

Thompson, Craig, "Building Usable Transportable Natural Language Interfaces to Databases," *1984 Workshop on Transportable Natural Language Interfaces*, Duke, October, 1984.

Thompson, Craig, "Building Usable Transportable Natural Language Interfaces to Databases," *Symposium on Computer Interfaces and Intermediaries for Information Retrieval*, Defense Technical Information Center, Williamsburg, VA, October 4-6, 1984.

Thompson, Craig. "Using a Menu-Based Natural Language Interface to Ask Spatial Database Queries," *Pecora IX: The Ninth William T Pecora Memorial Remote Sensing Symposium*, Sioux Falls, South Dakota, October 2-4, 1984.

Thompson, Craig. "Beyond Retrieval: Updating a Database using Menu-Based Natural Language Understanding," *Proceedings of the 1984 Conference on Intelligent Systems and Machines*, Oakland University, Rochester, Michigan, April, 1984.

Harry Tennant, Ken Ross, and Craig Thompson. "Usable Natural Language Interfaces Through Menu-Based Natural Language Understanding," *Proceedings of the Conference on Human Factors in Computing Systems*, Boston, MA, December, 1983.

Thompson, Craig, "Building Usable Natural Language Interfaces," *Defense Computer Graphics Conference*, Washington, October, 1983.

Thompson, Craig, Harry Tennant, Ken Ross, Rick Saenz. "Building Usable Menu-Based Natural Language Interfaces to Databases," *Proceedings of the 9th Very Large Database Conference*, Florence, Italy, October, 1983.

***Presentations related to Acxiom, DARPA or AFRL project reviews or DARPA program meetings***

Phillips, Reid, Wesley Deneke, Wingning Li, Craig Thompson, "Layout Inferencing and Domain-Specific Modeling Language," Design Reviews for Acxiom, Conway, 1/30/08, 10/29/08

Eno, Josh and Craig Thompson, DARPA Digital Object Storage and Retrieval (DOSR) workshop, Chantilly, Virginia, July 15-16, 2008. Josh's poster on search in virtual worlds was presented.

Hoag, Joe, Craig Thompson, "Applications of Synthetic Data Generation," *Conference on Applied Research in Information Technology*, Acxiom Laboratory for Applied Research, Conway AR, March 9, 2007, Conway AR.

Phillips, Reid, John Allison, Craig Thompson, "Subsetting the Workflow Grid," *Conference on Applied Research in Information Technology*, Acxiom Laboratory for Applied Research, Conway AR, March 9, 2007, Conway AR.

Thompson, Craig, Kyle Neumeier, "A Framework to Automate the Generation of BCDI Process Flows: Towards a High Level Business Language," *Acxiom Laboratory for Applied Research Conference*, Conway, AR, March 3, 2006, Conway AR.

Xiao, Zhichun, W. Li, and Thompson, Craig, "Workflow Automation," to Acxiom champions at critical milestone review, May 2005. PhD candidate Xiao was lead graduate student on this project.

Xiao, Zhichun, Wingning Li, and Craig Thompson, "Workflow Automation," *Acxiom Laboratory for Applied Research Conference (ALAR'05)*, University of Central Arkansas, Conway, Arkansas Feb. 18, 2005.

Xiao, Zhichun, W. Li, and Thompson, Craig, "Workflow Automation," to Acxiom champions at critical milestone review, December 2004. PhD candidate Zhichun presented a compelling demonstration of the first phase of work.

Brown, Barbara, Paul Morris, Craig Thompson, "Final Review," *Agent Supported Information Visualization* contract, AFRL, Rome Labs, September 23, 2003. Also presented at Kickoff and three semi-annual reviews.

Thompson, Craig, "Strawman Agent Architecture," Invited for: *DARPA Advanced Logistics Project Workshop*, Tampa, FL, December 8-10, 1998

Thompson, Craig, "Strawman Agent Architecture," Invited for: *DARPA/ISO Advanced Information Technology Services (AITS) Architecture Working Group*, MITRE, Washington DC, August 13, 1998.

Thompson, Craig, "Scaling Object Service Architectures to the Internet," Invited for: *DARPA BADD PI Workshop*, SRI, Menlo Park, CA, April 2, 1998

Thompson, Craig, Presentation on Object Service Architectures to Working Group #5: Web-based Design of Complex Systems, *DARPA ITO General PI Meeting*, Dallas, Texas, October 7-8 1996.

Thompson, Craig, "Object Services Architectures," *DARPA SISTO Symposium*, Chantilly, VA, August 28-31, 1995.

Thompson, Craig, "Software Architectures-Recommended Next Steps," *DARPA Workshop on POB/Interoperability*, La Jolla, California, 31 October-2 November 1994.

Thompson, Craig, "Open OODB Phase II Progress and Plans," *DARPA Persistent Object Base Workshop*, University of Wisconsin, Madison, 23-24 May 1994.

Thompson, Craig, "Object Database Standards and Open OODB," Invited for: US Navy Next Generation Computer Resources (NGCR) Database Integration Standards Working Group (DISWG), Monterey, California, 15 April 1993.

Thompson, Craig, "DARPA Open OODB: A Modular Open Object-Oriented Database System," invited presentation: National Institute of Standards and Technology (NIST), March 31, 1992.

Thompson, Craig, "DARPA Open OODB," invited for: DARPA Domain Specific Software Architecture Workshop, Los Angeles, California, July 30, 1991.

Thompson, Craig, "DARPA Open OODB," invited for: *DARPA Image Understanding Workshop*, Pacifica, California, 1991. Gathered requirements for Open OODB.

Thompson, Craig, "DARPA Open OODB," invited for: *DARPA Knowledge Representation System Standards Initiative Meeting*, MIT, April 26, 1991.

Thompson, Craig, "Open OODB Status and OODB Standards," invited for: *Second Annual DARPA/SISTO Principal Investigator's Meeting*, Providence, RI, February 27-28, 1991.

Thompson, Craig, "Strawman Issue Identification" and "OODB Standardization Status," invited for: *DARPA, NSF, ESPRIT Joint Exploratory Workshop on Information Science and Technology*, July 23-26, 1990.

Thompson, Craig, "Persistent Object Base/Distributed OODBs," invited for: *First Annual DARPA/ISTO Principal Investigator's Meeting*, Washington D. C., June 27-29, 1990.

Thompson, Craig, "OODB Standardization Status - X3/OODBTG and OMG," Liaison presentation to ANSI X3H6 CASE Integrated Systems (CIS), Dallas, Texas, June 13, 1990.

Thompson, Craig, "Object-Oriented Database Systems," invited for: *Army Artificial Intelligence/Database Management Systems Workshop*, Fort Gordon, GA, February 17-19, 1987.

#### ***Presentations to standards groups or about standards***

Thompson, Craig, "OODB Standardization Status," invited for: *Patricia Seybold Technology Forum on Object-Oriented and Distributed Computing*, Cambridge, MA, April 1, 1990. The three day forum gathered 400 middle-level managers and focused on distributed computing and object-oriented technologies as key technologies of the 1990s.

Many more presentations not listed – see III.D.3 and IV.B.1 for extensive DARPA and standards participation.

***Presentations at University of Arkansas and at other universities and schools***

Thompson, Craig, presentation to EAST students on virtual worlds, Greenland High School, January 2009

Thompson, Craig, Craig Thompson, "Modeling Healthcare Logistics in a Virtual World," Presentation at GIS Day, CAST, 11/19/2008.

Thompson, Craig, Amy Apon, Sree Malladi, Hung Bui, "Image Stitching using the Cell BE," presentation to IBM Executive VP Jim Stallings, 9/19/08 & presentation to Enterprise Computing Steering Committee, 11/13/08.

Thompson, Craig, Craig Thompson, "Healthcare Logistics in a Virtual World," presentation and demo to Freshman Engineering 10/03/08. I gave presentation to Freshman Honors, 10/23/08. My students Casey Bailey and Keith Perkins presented our Second Life project to six groups of prospective freshmen on 11/8/08.

Thompson, Craig, students, "Healthcare Logistics in a Virtual World," presentation and public demo to interested sponsors, faculty, students, EAST parents, 8/7/08 - two hours - shows SL videos and several presentations

Thompson, Craig, presentation to EAST students, Fayetteville High School, October 2008

Thompson, Craig, Josh Eno, Casey Bailey, Josh McFarlane, Keith Perkins, and Nick Farrer, "Healthcare Logistics in a Virtual World," presentation and demo to RFID Research Center board meeting on June 19, 2008 and December 11, 2008.

Thompson, Craig, Josh Eno, Casey Bailey, Josh McFarlane, Keith Perkins and Clinton Monk, "Healthcare Logistics in a Virtual World," presentation/demo to CIHL Board, May 14 2008 and October 21 2008. Thompson, Craig and students, "Everything is Alive Pervasive Computing Project," 2007 Freshman Academic Convocation, University of Arkansas, August 19, 2007

Thompson, Craig, "Research and Vision for CSCE," Head Search, CSCE Department, January 24, 2007

Thompson, Craig, "Real World Research Projects," CSCE Industrial Advisory Board, October 24, 2006.

Thompson, Craig, "Real World Research Projects," Enterprise Computing Steering Committee, October 27, 2006.

Thompson, Craig, Kyle Neumeier, "Real World Research Projects," Information Technology Research Institute Board Meeting, September 21, 2006.

Thompson, Craig, "RFID Enterprise Integration Architecture - A research plan for a middleware framework for RFID Center Testing," RFID Center Industrial Advisory Board Meeting, June 9, 2005.

Thompson, Craig, "Career Paths and Graduate School," Student ACM, University of Arkansas, Fayetteville, AR, April 4, 2005.

Thompson, Craig, "Curriculum and Research related to Enterprise Computing in CSCE," Enterprise Computing Steering Committee, Walton School of Business, February 9, 2005.

Thompson, Craig, "DBMS on a Grid," FY'05 Direct Funding Competition, December 1, 2004. Presentation to Van Scoyoc lawyers and Collis Geren. Bundled with Brent Smith's Homeland Security presentation.

Thompson, Craig, "Research Collaborations: Grids, Agents, Middleware," to CSCE Advisory Board, November 12, 2004 - one of four featured talks.

English, John, William Hardgrave, Fred Limp, Roy McCann, Craig Thompson, "Sensors and Pervasive Computing Technologies," to College of Engineering Industrial Advisory Board, October 22, 2004.

Thompson, Craig, "Research Progress Updates, ALAR Steering Committee, Acxiom TRESNET Conference, September 29, 2004.

Thompson, Craig, "Middleware & Agent Research in Progress," to CSCE Industrial Advisory Board, May 11, 2004 - one of four featured faculty.

Thompson, Craig, "Digital Fort Knox: Precision Information Sharing," to Asa Hutchison and Charles McQueary, Undersecretaries of Department of Homeland Security, April 16, 2004. (the main U of A presentation during their visit)

Thompson, Craig, "Digital Fort Knox: Precision Information Sharing," to Jonathan Askins (Acxiom Govt Division) and Geoff Shaw, Chief Strategist for Extreme Risk Solutions, Lockheed Martin Management and Data Systems, March 2004

Thompson, Craig, "Natural Language Query Service for the Semantic Web," CSCE Faculty Research Seminar, CSCE Department, University of Arkansas, February 25, 2004. Around 20 attendees.

Thompson, Craig, "Middleware," Acxiom Seminar Series, CSCE Department, University of Arkansas, February 13, 2004. Advertised to interested CSCE graduate students (J. Talburt, F. Davis, A. Apon, D. Thompson, ~10 grads, 1 undergrad). Covered aspect oriented computing which influenced John Talburt (Acxiom) to develop a presentation "Aspect-oriented Information Management"

Thompson, Craig, "Research Topics in Agent Technology," Agent Seminar Series, CSCE Department, University of Arkansas, January 24, 2004. About 30 graduate and undergraduate students attended.

Thompson, Craig, "Pervasive Computing Initiative @ University of Arkansas - first step: Wireless Campus-wide Infrastructure," FY'04 Direct Funding Competition, December 1, 2003. Presentation to Van Scoyoc lawyers and Collis Geren.

Thompson, Craig, "Software Architectures, Aspects, XML and Security," CSCE Department, Acxiom Seminar Series, November 10, 2003.

Thompson, Craig, "Homeland Security," one of three 20 minute faculty presentations to College of Engineering Advisory Council, October 10, 2003

Thompson, Craig, "Everything is Alive," presentation to CSCE Department, University of Arkansas, Fayetteville, June 2003.

Thompson, Craig, "Everything is Alive," presentation to Computer Science Department, Naval Postgraduate School, Monterey, CA, May 2003.

Thompson, Craig, "Emerging Object Technology Standards," Presentation to Computer Science Faculty, University of Texas at Dallas, December 16, 1993.

Thompson, Craig, "Natural Language Interfaces," invited for: Computer Science Department Colloquium Series, The University of Texas, Dallas, January 24, 1986.



Thompson, Craig, "Towards a Fileless Environment-The Missing Hypermedia Layer," invited for: Computer Science Department Colloquium Series, The University of Texas, Dallas, January 24, 1986.

Thompson, Craig, "Menu-Based Natural Language Interfaces To Databases," invited for: Computer Science Department Colloquium Series, Southern Methodist University, Dallas, September 11, 1985.

Thompson, Craig, "Natural Language Interfaces," invited for: Student Chapter of the ACM, University of Texas at Dallas, November, 1984.

Thompson, Craig, "Natural Language Interfaces," IEEE Computer Society, Dallas, October, 1984.

Thompson, Craig, "Hierarchical Text Generation of Encyclopedia Articles," Oak Ridge National Labs, January, 1980.

Thompson, Craig, "Frontiers in Natural Language Research," Mathematics Department, South West Texas State University, San Marcos, Texas, 1977.

### **Doctoral Dissertations, Masters Theses, and Honors Theses Directed**

From 1986 to 2003, in my role as research manager and principal investigator at TI and OBJS, I supervised full-time Ph.D. and M.S. researchers, including on several DARPA-funded research projects.

#### ***Ph.D. Dissertations***

##### Supervised at University of Arkansas - completed

Hoag, Joseph, "Synthetic Data Generation: Theory, Techniques and Applications," Ph.D. Dissertation, Computer Science and Computer Engineering Department, start date: January 2005, Successfully defended: December 2007. Turned in dissertation May 2008. Took job with Microsoft in Seattle. Committee: Craig Thompson, Wingning Li, Brajendra Panda, Joe was a Distinguished Doctoral Fellow.

##### Supervised at University of Arkansas - in progress

Eno, Josh, "An Intelligent Crawler for a Virtual World," PhD Dissertation, CSCE Dept., Expected completion: August 2009. Completed qualifying exam in Feb07; completed MS in Spring 2007; completed proposal defense in Nov08; PhD defense expected August 2009. Co-supervisor w Susan Gauch.

Phillips, Reid, "Text File Layout Inferencing," PhD Dissertation, CSCE Dept., Expected completion: August 2009. Completed MS in Aug06; passed qualifying exam in Feb08; completed proposal defense in Nov08; PhD defense expected August 2009. Co-supervisor w Wingning Li.

Deneke, Wes, "A Domain Specific Model for Generating ETL Workflows from Business Intent," PhD Dissertation, CSCE Dept., Proposal defense expected in 1Q09; expected completion: August 2009 or later. Co-supervisor w Wingning Li.

##### On Committee at Southern Methodist University - completed

Lu, Baochuan, "An Integrated Capacity Planning Environment for Enterprise Grids," CSCE, May 2008, Committee: Amy Apon, Craig Thompson, Dennis Brewer, Dale Thompson, Wingning Li

Jaradat, Ameera, "Semantic Mining of Networks with Scale-Free Structure," CSCE, Committee: Russell Deaton, Craig Thompson, Wingning Li, Nebil Buyurgan. Topic Defense: February 2007. Dissertation defense in early Spring 2008 - completed revisions and sign off Summer 2008.

Hadzikadic, Mirsad, "Concept Formation by Heuristic Classification, Southern Methodist University, Dallas, Texas 1987. Now: Mirsad is Dean, College of Information Technology, University of North Carolina at Charlotte.

### ***M.S. Theses***

#### Supervised at University of Arkansas - completed

Kirkconnell, Evan, "GRINDEX3: Extensible Grid Indexing and Query Service," M.S. Thesis, Computer Science and Computer Engineering Department, University of Arkansas, December 2008. Committee: Craig Thompson, Wingning Li, Brajendra Panda

Musunuri, Swathi, "Performance and Scalability of TagCentric RFID Middleware," M.S. Thesis, Computer Science and Computer Engineering Department, University of Arkansas, Committee: Craig Thompson, lookup, Aug 2008

Barath, Suman, "Message Reliability over UDP," M.S. Thesis, Computer Science and Computer Engineering Department, University of Arkansas, May 2008. Committee: Craig Thompson, Dale Thompson, Bob Crisp. May 2008.

Neumeier, Kyle, "Smart Device Virtualization: Building an LLRP RFID Reader Emulation Tool," M.S. Thesis, Computer Science and Computer Engineering Department, University of Arkansas, May 2008.

Barath, Suman, "Message Reliability over UDP," M.S. Thesis, Computer Science and Computer Engineering Department, University of Arkansas, May 2008. Committee: Craig Thompson, Dale Thompson, Bob Crisp, CSCE Dept, May 2008.

Josh Eno, "Generation of Synthetic Data to Conform to Constraints Derived from Data Mining Applications," M.S. Thesis, Computer Science and Computer Engineering Department, University of Arkansas, December 2007. Committee: Craig Thompson, Brajendra Panda, Dave Douglas

Vinitha Reddy Chintaphally, "Extending Menu-based Natural Language Interfaces with Geospatial Queries," M.S. Thesis, Computer Science and Computer Engineering Department, University of Arkansas, December 2007. Committee: Craig Thompson, Jack Cothren, Gordon Beavers, Brajendra Panda

Sidhartha Sumanta, "RFID Reader Agent Based On Low Level Reader Protocol (LLRP) Standards," Masters Project, Computer Science and Computer Engineering Department, University of Arkansas, August 2007. Committee: Craig Thompson, Gordon Beavers, Amy Apon

Phillips, Reid, "GRINDEX2: Extensible Indexing in a Grid-Based Relational Database Management System," M.S. Thesis, Computer Science and Computer Engineering Department, University of Arkansas, December 2006. Committee: Craig Thompson, Amy Apon, Dale Thompson

Jonnalagedda, Vijaya Satya Kalyan, "Performance Analysis and Tuning of a Very Large Retail Application implemented on a Grid-based Database Management System," M.S. Thesis, Computer Science and Computer Engineering Department, University of Arkansas, August 2006. Committee: Craig Thompson, Brajendra Panda, Amy Apon

Jena, Rishikesh, "Digital Licensing Service in a Scalable Agent System," M.S. Thesis, Computer Science and Computer Engineering Department, University of Arkansas, May 2006. Committee: Craig Thompson, Henry Hexmoor, Gordon Beavers

Robertson, Joseph, "Architecture of an Extensible Agent System," M.S. Thesis, Computer Science and Computer Engineering Department, University of Arkansas, May 2006. Committee: Craig Thompson, Amy Apon, Henry Hexmoor

Schisler, Jonathan, "GRINDEX: Framework and Prototype for a Grid-based Index," M.S. in Computer Engineering, Computer Science and Computer Engineering Department, University of Arkansas, August, 2005.

Supervised at University of Arkansas - in progress

Ahmad, Ala'a (Alex), "Modeling Healthcare Logistics in a Virtual World: the Database Connection," M.S. Thesis, Computer Science and Computer Engineering Department, University of Arkansas, May 2009. Committee: Craig Thompson, Brajendra Panda, Gordon Beavers

Malladi, SreeVardhani, "Using System z and Cell/BE to Accelerate an Image Stitching Algorithm," M.S. Thesis, Computer Science and Computer Engineering Department, University of Arkansas, May 2009. Committee: Craig Thompson, Amy Apon

Harrison, Lisa, "Subsetting the Workflow Grid," M.S. Thesis, Computer Science and Computer Engineering Department, University of Arkansas, Expected: May 2009. Committee: Craig Thompson, Amy Apon, Brajendra Panda

Bailey, Casey, Topic TBD - will be related to Second Life, M.S. Thesis, Computer Science and Computer Engineering Department, University of Arkansas, Aug 2009. Committee: Craig Thompson, tbd.

On Committee at University of Arkansas - completed

Bui, Hung, "Fairshare Scheduling - A Case Study," MS Thesis, CSCE Dept., Dec 2008. Committee: Amy Apon, Craig Thompson, Dale Thompson

Neelapala, Dinesh, "Using FP-Growth Algorithm for Database Intrusion Detection," MS Thesis, CSCE Dept., Dec 2008. Committee: Brajendra Panda, Craig Thompson, Dale Thompson

Hayes, Don, "A CORBA-based Distributed and Multi-Threaded Algorithm for Finding Related Records in a Large Data Set," MS Thesis, CSCE Dept., Dec 2008. Committee: Wingning Li, Brajendra Panda, Craig Thompson

Lehlou, Nabil, "An Agent-Based Architecture of a Remotely Controllable Laboratory System for an Online RFID Learning Environment," MS Thesis, INEG Dept., December 2008. Committee: Nebil Buyurgan, Justin Chimka, Craig W. Thompson

Ramanathan, Naveen, "Grouping Mechanism for Agent Based Damage Assessment," CSCE Dept., Aug 2008. Committee: Brajendra Panda, Craig Thompson, Wingning Li

Nugmanov, Yermek, "Cost-Effective Optimization of Data Dependency Based Intrusion Detection System," CSCE Dept., Aug 2008. Committee: Brajendra Panda, Craig Thompson, Dale Thompson

Patton, Justin, "RFID as Electronic Article Surveillance: Feasibility Assessment," CSCE Dept., May 2008. Committee: Pat Parkerson, Craig Thompson, Dale Thompson

Chagarlamudi, Manideep, "Identifying Unauthorized Activities by Insiders in a Database System," CSCE Dept, December 2007. Committee: Brajendra Panda, Craig Thompson, Dale Thompson

Lehlou, Nabil, "Building a Smart Devices Integration Framework that Supports a Collaboratory Learning Environment," Industrial Engineering Dept., May 2008. Committee: Nebil Buyurgan, Justin Chimka, Craig Thompson

Uudmae, Jaanus, "Analysis of the Privacy Policies of Most Visited Web Sites," CSCE Dept, May 2007. Committee: Dale Thompson, Craig Thompson, Brajendra Panda

Bheemavaram, Roopa, "Parallel And Distributed Grouping Algorithms for Finding Related Records of Huge Data Sets On Cluster Grids," M.S. Thesis, Computer Science and Computer Engineering Department, University of Arkansas, August 2006. Committee: Wingning Li, Gordon Beavers, Craig Thompson.

Baker, Matt, "Methods for Maintaining Local Cluster Resources for Intercampus and Intracampus Grids," M.S. Thesis, Computer Science and Computer Engineering Department, University of Arkansas, August 2006. Committee: Amy Apon, Craig Thompson, Dale Thompson

Carter, Walt, "Sensor Fusion Methods Applied to a Mobile Robot," Electrical Engineering Dept., University of Arkansas, August 2006. Committee: Roy McCann, Craig Thompson, Neil Schmitt

Akula, Rajesh, "An Agent-based Methodology for Comparing Service Policies using a Dynamic Trust Model," M.S. Thesis, Computer Science and Computer Engineering Department, University of Arkansas, August 2006. Committee: Henry Hexmoor, Craig Thompson

Ngo, Linh, TBD, M.S. in Computer Engineering, Computer Science and Computer Engineering Department, University of Arkansas, December 2005. Committee: Amy Apon, Craig Thompson

Bhattaram, Sandeep, "A Soft Security Approach Towards Achieving Secure & Trusted Information Sharing Multi-Agent Communities," M.S. in Computer Science, Computer Science and Computer Engineering Department, University of Arkansas, December 2005. Committee: Henry Hexmoor, Craig Thompson

Pasupuleti, Subba Rao, "A Coordinated Multiple Sensor Surveillance System," December 2005, CSCE Dept, Advisor: Henry Hexmoor. Not on committee but asked by committee head to review thesis and participate in defense

Medala Sucharita, "Using Simulated Annealing to Explore Semi-Random Magnetic Dot Structures," CSCE Dept, December 2005, Advisor: John Lusth

Chaudhary, Neeraj, "RFID Technical Tutorial and Threat Modeling," CSCE Dept, December 2005, Advisor: Dale Thompson, Not on committee but asked by committee head to review thesis and participate in defense as co-author of paper

Preethi, Sanathi, "Man on the Loop," M.S. in Computer Science, Computer Science and Computer Engineering Department, University of Arkansas, December 2005. Committee: Henry Hexmoor, Craig Thompson

Taylor, Bart, "Architectural Tradeoffs for Unifying Campus Grid Resources," M.S. in Computer Science, Computer Science and Computer Engineering Department, University of Arkansas, December, 2005. Committee: Amy Apon, Craig Thompson

Loh, Yein Yein, "Partitioning Mechanism for In-Memory Distributed Database," M.S. in Computer Engineering, Computer Science and Computer Engineering Department, University of Arkansas, August 2005. Committee: Dale Thompson, Craig Thompson.

White, Jonathan, "American Dataset Generation Program: Creation, Applications, And Significance," M.S. in Computer Engineering, Computer Science and Computer Engineering Department, University of Arkansas, August 2005. Committee: Dale Thompson, Craig Thompson

Chundu, Venkata Praveen, "Mediating Distributed Intentionality in Agent Communities," M.S. in Computer Science, Computer Science and Computer Engineering Department, University of Arkansas, December 2005, Advisor: Henry Hexmoor, Craig Thompson

Eluru, Swetha, "Plan Sharing: Showcasing Coordinated UAV Formation Flight," M.S. in Computer Science, Computer Science and Computer Engineering Department, University of Arkansas, May 2005. Committee: Bob Crisp (Henry Hexmoor), Craig Thompson

Ravalkol, Ram Kumar, "Service Restorability in Degree-Base Wavelength Division Multiplexing Networks," M.S. in Computer Engineering, Computer Science and Computer Engineering Department, University of Arkansas, May 2005. Committee: Dale Thompson, Craig Thompson

Tinker, Michael, "A Simulation for Research on the Unified Adaptive Model of the Acxiom Grid," M.S. in Computer Science, Computer Science and Computer Engineering Department, University of Arkansas, May 2005. Committee: Amy Apon, Craig Thompson

Venkata, Satish Gunnu, "Modeling Social Norms in Multi-Agent Systems," M.S. in Computer Engineering, Computer Science and Computer Engineering Department, University of Arkansas, May 2005. Committee: Henry Hexmoor, Craig Thompson

#### On Committee at University of Arkansas - In progress

Asante, Kwasi, "Design of an Operations Support System for the Terrahawk Aerial Imaging System," Geosciences Dept., May 2009, Committee: Jackson Cothren, Jason Tullis, Craig Thompson

#### M.S. Theses in MIT VI-A COOP Program as Industrial Advisor while at Texas Instruments - completed

My role as industrial advisor in the following MIT Coop M.S. theses was as primary thesis advisor - to work with the student to identify the thesis topic, oversee the work over typically a six month period, including reviewing the writing of the thesis report.

Bayardo, Roberto. "Constructing Information Organizing Systems," M.S. Thesis, MIT VI-A Co-op Program, Department of Electrical Engineering and Computer Science, MIT, 1991. Industrial advisor joint with Tom Malone (MIT Sloane School). Step towards an object-file system.

DiPesa, Anthony. "Extensions to a Relational Database to Support Real-time Applications," M.S. Thesis, MIT VI-A Co-op Program, Department of Electrical Engineering and Computer Science, MIT, 1986. Industrial advisor joint with Nancy Lynch (MIT). Thesis provides an implementation of incrementally materialized views, allowing easy-to-specify dynamic windows on simulations or real-time events, e. g. "Show enemy planes within 3 miles of target T" (dynamically displayed on a map).

Martin, Steve. "Database Support for Cooperative Response," M.S. Thesis, MIT VI-A Co-op program, Department of Electrical Engineering and Computer Science, MIT, 1986. Industrial advisor joint with John Gifford (MIT). Thesis develops efficient techniques to help end-user reformulate ad hoc queries with empty or unexpected results.

Hemphill, Charles. "Predictive Parsing Using Lexical Functional Grammar," M.S. Thesis, Department of Computer Science, Southern Methodist University, Dallas, Texas, 1985. Industrial advisor joint with Robert Korphage (SMU). Based on my earlier work on menu-based natural language technology.

Directly led to "System and method for parsing natural language by unifying lexical features of words", US Patent 5,083,268, January 21, 1992 and to the NLParse implementation of MBNLI, later used by DARPA Spoken Language projects.

Eisen, Jeffrey. "A Software Cache Management System," M.S. Thesis, MIT VI-A Co-op program, Department of Electrical Engineering and Computer Science, MIT, 1985. Industrial advisor joint with Richard Zippel (MIT). A generic software cache management service (in the OMG Object Services sense).

M.S. at University of Tennessee, Knoxville - completed

Lin, Benjamin. "Database Abstractions: An Interpretation and Implementation," M.S. Thesis, Department of Computer Science, The University of Tennessee, Knoxville, 1981. Based on a generalization of Smith and Smith's work on aggregation and generalization.

Evans, Elliot, "Relational DBMS on a PC," M.S. Thesis, Department of Computer Science, The University of Tennessee, Knoxville, 1980. An early, powerful PC-based relational DBMS implementation, based on my SUR Relational DBMS design; considered for productization. [See C. Thompson. "SUR: A Single User Relational Database Management System," CS-80-45, Technical Report, Department of Computer Science, The University of Tennessee, Knoxville, August, 1980. Design for a PC-based relational DBMS, implemented as a class project.]

*B.S. Honors Theses*

Supervised at University of Arkansas - completed

Casey Bailey, "Extending Second Life Simulations with Virtual RFID," BS Honors Thesis, CSCE Dept., Spring 2008. Committee: Craig Thompson, Pat Parkerson, Gordon Beavers

Josh McFarlane, "Mapping Reality into Virtual Worlds," BS Honors Thesis, CSCE Dept., August 2008. Committee: Craig Thompson, Pat Parkerson, Gordon Beavers

Lehlou, Nabil, "Extending EiA Soft-controllers with a Natural Language Interface," B.S. Honors Thesis, Computer Science and Computer Engineering Department, University of Arkansas, August 2006. Committee: Craig Thompson, John Lusth, Bill Hardgrave.

Neumeier, Kyle, "Dynamic Composition of Agent Grammars," B.S. Honors Thesis, Computer Science and Computer Engineering Department, University of Arkansas, May 2006. Committee: Craig Thompson, Gordon Beavers, Wingning Li. Kyle's thesis will be published in Inquiry Journal of Undergraduate Research, University of Arkansas. Now in grad school at U Arkansas.

Allen, Jared, "Natural Language Plugin for Multi-Agent System," B.S. Honors Thesis, Department of Computer Science and Computer Engineering, University of Arkansas, May 2005. Jared's thesis was published in Inquiry Journal of Undergraduate Research, University of Arkansas.

Olagunju, Oladayo, "Alternatives for Implementing Wireless Frameworks in Emerging Economies," B.S. Honors Thesis, Department of Computer Science and Computer Engineering, University of Arkansas, May 2005. Now at Stanford Business School.

Doyle, James Matt, "Implementing a Port Knocking System in C," B.A. Thesis, University of Arkansas, May, 2004. Now in grad school at CMU.

Supervised at University of Arkansas - in progress

B.S. Honors Theses - On Committee - completed

Barrett Miller, "Steganography in IPv6," BS Honors Thesis, CSCE Dept., December 2008.

Committee: Dale Thompson, Craig Thompson, Russell Deaton

Baran, Jonathan, "A Service based Approach to the Distributed Transitive Closure Problem," BS

Thesis, Aug 2008. Committee: Wingning Li, Craig Thompson, Russell Deaton

Guevara, Marisabel, "Visualization of an Approach to Data Clustering," BS Thesis, May 2008.

Committee: Parkerson, Deaton, Thompson

Bryan, Chris, "Holistic Characterization of Parallel Programming Models in a Distributed Memory

Environment," BS Thesis, May 2008. Committee: Amy Apon, Russell Deaton, Craig Thompson

Ownbey, Suzanne, "Pitch Correction on the Human Voice," BS Thesis, May 2008. Committee: John

Lusth, Craig Thompson, Russell Deaton

Weaver, Jesse, "Using XML To Bridge The Semantic Gap Between Hardware Programming And

Software Programming," B.S. Honors Thesis, Department of Computer Science and Computer

Engineering, University of Arkansas, May 2006. Committee: Pat Parkerson, Craig Thompson, Jia Di.

Now at Raytheon.

Johnson, Steve, "User Interfaces For Complex, Agent Based Systems," B.S. Honors Thesis,

Department of Computer Science and Computer Engineering, University of Arkansas, May 2006.

Committee: Henry Hexmoor, Craig Thompson, Allen Baker

***TI Idea Program - similar to M.S.***

Matzke, Douglas. "Incremental Algorithms," TI Idea Program Project (\$20K). Advisor: Craig

Thompson. Based in part on work by DiPesa and Eisen (above), this project led to the SC/SPDC

Three Month Design System (DROID) approach to fine-grained change management (Keeps) and,

indirectly, to its Meta Simulator, a novel, very efficient incremental RTL simulator based on lazy

evaluation. Ideas appear to provide a basis for some kinds of incremental algorithms.

***Other papers published by my students***

Neumeier, Kyle, "Dynamic Composition of Agent Grammars," *Inquiry Journal of Undergraduate*

*Research*, University of Arkansas, Fall 2006 issue.

Allen, Jared, "Interfacing Agents with Natural Language," *Inquiry Undergraduate Research*

*Journal*, University of Arkansas, Fall 2005 issue.

Harris, Chris, "Evolving Multi-Agent and P2P Networks using WSDL and SOAP," *IEEE International*

*Conference on Integration of Knowledge Intensive Multi-Agent Systems (KIMAS)*, Waltham, MA,

April 18-21, 2005.

Also see five papers co-authored with University of Arkansas students at the KIMAS'05

conference.

Vu, Minh, "E2 Plugin Architecture," *Acxiom Laboratory for Applied Research Conference*, February

2005, Conway AR. (83% acceptance rate for student papers)

Kubozono, Midori, "Last Frost Problem," *Inquiry Undergraduate Research Journal*, University of

Arkansas, Fall 2004 issue. Wal-Mart champion Bruce Firth, Predictive Simulation Systems &

Strategy Manager, Information Systems Division, Wal-Mart, indicates his group extended Midori's work to cover First Frost of the Fall and fanned the project out to 3000 Wal-Mart stores.

## **Inventions**

### ***Patents Issued***

Tennant, Harry, Rick Saenz, Ken Ross, Craig Thompson, and James Miller. "Menu-Based Natural Language Understanding." Patent application filed January 1983. U.S. Patent 4,829,423 issued May 1989. Fundamental patent in the natural language interface area. User selects words and phrases from menus to complete a natural language query or command. One of 5 TI patents issued in 1989 to receive a top patent award: \$10,000 per inventor. Non-exclusive license to Symantec for use with Q&A product in 1990. One of the earlier software patents. My name is not shown on the USPTO website but USPTO confirms my name is on the patent.

Thompson, Craig, Ken Ross. "Natural Language Interface Generating System." Patent application filed January 1983. U. S. Patent 4,688,195 issued August 1987. Fundamental patent in the natural language interface area. Enables automated generation of menu-based natural language interfaces, esp. to relational databases. Capability was used to win \$48M G/AIT contract for TI DSEG; key technology used in several other TI contracts (FRESH, Robotic Air Vehicles, DARPA Spoken Language, and at TI Freising, Germany) as well as three TI products (Natural Access, Natural Link, NLParse).

Bannon, Tom, Steve Ford, John Joseph, Edward Perez, Robert Peterson, Diana Sparacin, Satish Thatte, Craig Thompson, Chung Wang, David Wells. "System and Method for Database Management Supporting Object-Oriented Programming," Patent application filed May 1990. U.S. Patent 5,297,279 issued March 1993. Child patent U.S. Patent 5,437,027 issued July 1995. OODB patent - covers method for adding persistence to programming languages Lisp and C++.

Srivastava, Aditya, Jose Blakeley, Steve Ford, Moira Mallison, Craig Thompson, David Wells. "Apparatus and Method for providing an Object Event Detection and Notification Service via an In-Line Wrapper Sentry for a Programming Language." Patent application filed January 1993. U.S. Patent 5,752,034 issued May 1998. Important OODB and distributed systems invention that describes an event/interceptor service for C++. Used as a basic mechanism to seamlessly "add services" like persistence or versioning to C++ class definitions, including legacy code.

Blakeley, Jose, Craig Thompson. "Apparatus and Method for Adding an Associative Query Capability to a Programming Language." Patent application filed April 1990. U.S. Patent 5,761,493 issued June 1998. U.S. Patent 5,826,077 issued October 1998 (with revised claims?). Describes a generic Object Query Service that provides a means of combining the SQL database query language with any object-oriented programming language X (e. g., OQL[X]) as well as a specific demonstration using C++ (e. g., OQL[C++]). VERSANT (OODB vendor) developed a product based on the OQL[C++] interface specification. Specification based on this work submitted to OMG in September 1994.

Joseph, John, Mark Shadowens, Craig Thompson, John Chen. "Apparatus and Method for Providing a Facility for Managing Versions and Configurations of Persistent and Transient Objects," Patent application filed May 1990. U.S. Patent 5,787,280 issued July 1998. U.S. Patent 5,862,386 issued January 1999 (with broader claims). Covers a generic change management service, CMS[X], that can be added to any object-oriented programming language X.



Pazandak, Paul and Craig Thompson. "Guided Natural Language Interface System and Method." Submitted by OBJS to USPTO in August 2000, revised claims submitted August 2001, U.S. Patent 7,027,975 issued April 11, 2006. Covers methods of distributing menu-based natural language interfaces for delivery on Web (requiring no user side installation), methods of composing interfaces, methods of extracting remote DBMS schemas and auto-generating NLMenu interfaces on the fly, and describes how to add this capability to search engines. Potential to deploy on any web page, to provide remote access to any web-accessible DBMS or to communicate with devices. Assigned to Craig Thompson by agreement with OBJS.

Bannon, Tom. "Network query and matching system and method." Submitted by OBJS to USPTO in September 1999. US Patent 6,963,863 issued on Nov 8 2005. Covers scalable trader that uses XML for ads and that uses commercial-of-the-shelf search engines to locate ads. My role: drafted claims and co-authored patent description. Assigned to Craig Thompson by agreement with OBJS.

### ***Patent Application - Abandoned***

Srivastava, Aditya, Steve Ford, Edward Perez, Craig Thompson, David Wells. "Apparatus and Method for Object Externalization and Internalization." Patent Application filed January 1993. Provides serialization for C++, that is, permits automated copying of C++ data structures to external environment. Basic operation in seamless Persistent C++ and seamless Distributed C++. Precursor to Java serialization. *Abandoned* - not sure why.

### ***Patent Support***

Pazandak, Paul. "Type-specific objects from markup and web-oriented languages, and systems and methods therefor." Submitted by OBJS to USPTO in February 1999. Covers basic technique for XML-to-Java mapping. My role: drafted claims.

### **Products**

*TI Explorer Lisp Machine NLMenu: Menu-Based Natural Language Interface (MBNLI) System, 1981-1986.* Co-invented "menu-based natural language" interfaces. User selects words and phrases from menus to form English sentences; predictive parser, driven by attribute grammar, populates menus. Also co-invented interface generator to auto-generate NLMenu interfaces to relational DBMS, business graphs, and spatial DBMSs. Principal designer and directed development of TI NLMenu product sold on the TI Explorer Lisp Machine. Designed demonstrations shown at AAAI'84 through AAAI'86. Consulted for TI Natural Link, Natural Access, and NLParse products based directly on this work. Helped negotiated non-exclusive license to Symantec for Q&A product. Based on my demo, MBNLI technology directly influenced win of \$48M Ground/Air Interactive Terminal (G/AIT) military contract. NLMenu was deployed at CINCPACFLT in Hawaii in system to manage the readiness of the USN Pacific Fleet in DARPA USN Force Requirements Expert System (FRESH) program and a Prolog variant NLParse was used in the DARPA Spoken Language Database program. Received \$10K TI patent incentive award in 1989.

*TI Explorer Lisp Machine RTMS Relational Table Management System, 1981-1984.* Designed, prototyped, and directed development of RTMS, a relational database product on the TI Explorer Lisp Machine. RTMS was the first commercially available relational system to support objects (using Lisp flavors).

*TI Explorer Lisp Machine Tree Editor*, 1984. Conceived and directed development of this product.

## Software Research Contracts and Projects

### *Principal Investigator (PI), Co-PI or Key Contributor*

#### Over \$19K in Grants, Honors College, University of Arkansas (Mentor)

Allen, Jared, *Controlling Agents and Robots using Natural Language*, May - December 2004, \$2,800, Undergraduate Research Grant, Honors College, University of Arkansas. Mentor: Craig Thompson, Computer Science and Computer Engineering Department, College of Engineering.

Allen, Jared, *Interfacing Agents with Natural Language*, January-May 2005, Undergraduate Research Grant, Honors College, University of Arkansas. Mentor: Craig Thompson, Computer Science and Computer Engineering Department, College of Engineering. Resulted in conference paper, honors thesis and *Inquiry* journal paper.

Bailey, Casey, "Extending Second Life Simulations with Virtual RFID," Honors College Undergraduate Research Grant, Awarded: 2/11/08, \$2421 stipend for student + \$1000 for mentor

Caloianu, Ciprian, *Digital Rights Management for Multi-Agent Systems*, March - October 2004, \$2,800, Undergraduate Research Grant, Honors College, University of Arkansas. Mentor: Craig Thompson, Computer Science and Computer Engineering Department, College of Engineering. Resulted in conference paper.

Doyle, Matt, *Implementing a Port Knocking System*, February - May 2004, \$1,180, Undergraduate Research Grant, Honors College, University of Arkansas. Mentor: Craig Thompson, Computer Science and Computer Engineering Department, College of Engineering. Resulted in honors thesis.

Duong, Quang, *Interfacing Agents and Robots through XML Messages*, May - December 2004, \$2,800, Undergraduate Research Grant, Honors College, University of Arkansas. Mentor: Craig Thompson, Computer Science and Computer Engineering Department, College of Engineering. Resulted in conference paper and contributed to full ride to Harvard.

Duong, Quang, *Data Mining and Scenario View Simulation in the Everything is Alive Agent System*, January-May 2005 Undergraduate Research Grant, Honors College, University of Arkansas. Mentor: Craig Thompson, Computer Science and Computer Engineering Department, College of Engineering.

Lehlou, Nabil, *Standard XML Interface for RFID Readers*, August-December 2005 Undergraduate Research Grant, Honors College, University of Arkansas. Mentor: Craig Thompson, Computer Science and Computer Engineering Department, College of Engineering.

McFarlane, Josh, "Mapping Reality into Virtual Worlds," Honors College Undergraduate Research Grant, Awarded: 2/11/08, \$2421 stipend for student + \$1000 for mentor

Neumeier, Kyle, *Dynamic Composition of Agent Grammars*, August-December 2005, Undergraduate Research Grant, Honors College, University of Arkansas. Mentor: Craig Thompson, Computer Science and Computer Engineering Department, College of Engineering.

Olagunju, Oladayo, *Pervasive Computing: Leapfrogging Emergent Nations' Networks into a Wireless Future*, March - October 2004, \$2,800, Undergraduate Research Grant, Honors College, University

of Arkansas. Mentor: Craig Thompson, Computer Science and Computer Engineering Department, College of Engineering.

Olagunju, Oladayo, *Alternatives for Implementing Wireless Frameworks in Emerging Economies*, January-May 2005, Undergraduate Research Grant, Honors College, University of Arkansas.

Mentor: Craig Thompson, Computer Science and Computer Engineering Department, College of Engineering. Contributed to honors thesis and full ride to Stanford Business School.

Smith, Kevin. *Lightweight Agent System*, March - October 2004, \$2,800, Undergraduate Research Grant, Honors College, University of Arkansas. Mentor: Craig Thompson, Computer Science and Computer Engineering Department, College of Engineering. Contributed to admission to CMU for graduate school.

White, Kyle. "Multi-user Web-based Menu-based Natural Language Interfaces," January-May 2007, \$1,650, Undergraduate Research Grant, Honors College, University of Arkansas. Mentor: Craig Thompson, Computer Science and Computer Engineering Department, College of Engineering.

#### \$26,600 Award by ASTA to CSCE and EAST

PI Craig Thompson, "Modeling Healthcare Logistics in Second Life," Summer 2008. Paid for one GRA, six EAST students, and one project consultant.

#### \$33,500 IBM Faculty Award

PI Craig Thompson, Co-PI: Amy Apon. "Cell Accelerator connected to System Z, 1/08-12/08

#### \$790K NSF MRI Equipment Grant

PI: Amy Apon, Co-PIs: Laurent Bellaiche, Huaxiang Fu, Peter Pulay, Craig Thompson. MRI: "Acquisition of a Supercomputing Cluster for Computational and Data-Intensive Applications in Science and Engineering," NSF Proposal 2007-2009, \$790K.

#### \$65K Acxiom Corporation + zero cost extension

PI: Wingning Li, Co-PI: Craig Thompson, "Domain-specific Modeling Language," Acxiom Laboratory for Applied Research, 6/07 - 5/09.

#### \$65K Acxiom Corporation + ~\$30K extension

PI: Wingning Li, Co-PI: Craig Thompson, Gordon Beavers, "Layout Inference: A Statistical and Combinatorial Approach," Acxiom Laboratory for Applied Research, 6/07 - 5/09.

#### \$4K SensorConnect

PI Craig Thompson. "SensorConnect: Proof of Concept," 12/06-5/07, funds Joe Hoag and Reid Phillips

#### \$65K Acxiom Corporation

PI Craig Thompson. "Subsetting the Acxiom Grid," 6/1/06 - 5/31/07, funds 1 GRA: Reid Phillips.

#### \$111K Oracle Corporation

PI Craig Thompson. "Oracle Grid DBMS Proof of Concept - Phase I," 8/16/05 - 6/15/06, funds 3 GRAs: Joe Hoag, Josh Eno, and Kalyan.

\$37K Acxiom Corporation

PI Craig Thompson. "A Framework to Automate the Generation of BCDI Process Flows," 5/15/05 - 5/14/06, funded 1 GRA: Ming Vu.

\$80K Acxiom Corporation

PI C. Thompson, Co-PI Wingning Li, "A Framework to Automate the Generation of BCDI Process Flows," 5/15/04 - 5/14/05, \$80K - funded 3 GRAs: Zhichun Xiao, Chris Harris, Reid Phillips

\$153K Acxiom Corporation

PI D. Thompson, Co-PI C. Thompson, A. Apon, "Grid Node Failover and Partitioning," 5/15/04 - 5/14/05, \$153K - funded 4 GRAs: Jonathan Schisler, Jonathan White, Yien Yien Loh, Taneem Ibrahim

\$8,426K Equipment

PI: Amy Apon, Senior Investigator: Craig Thompson, others. "MRI: Acquisition of a Computing Cluster for High-End Applications in Science and Engineering (CHASE)," National Science Foundation, 8/1/04 - 6/31/06.

PI: R. Crisp, Co-PI: D. Douglas, F. Davis, C. Thompson, B. Panda, W. Hardgrave, "NCR Teradata, 1995-2005," approx \$8,000,000, (\$4M equipment, \$2M maintenance, \$2M software upgrade), Contributed \$5,000.

\$195K (OBJS Share) AFRL SBIR Phase II - Agent Supported Information Visualization - 2001-2003

Proposal Co-Author and Key Person, *Agent-Supported Information Visualization*, SBIR Phase II, Air Force Research Laboratory, AFRL PM: Sharon Walter, Contract No. F30602-01-C-0189. Contract Duration: 25 September 2001 - 24 September 2003. OBJS subcontractor to ScenPro, Inc., Plano, Texas.

Developed architecture, requirements, agent-based architecture, small unit operations (SUO) ontology, detailed terrorist-at-airport scenario, explicit scenario representation, XML messaging, subscriptions and filters, agent middleware based solution using OBJS eGents (agents that communicate via email), agent simulation useful for after action analysis and rerunning subsets of the action. Completing Final Report now.

Brown, P. Morris, C. Thompson, "Agent Supported Information Visualization (Small Unit Operations Communicator)," *Final Report*, AFRL SBIR Phase II, Contract No. F30602-01-C-0189, Sept 25, 2003. Authored 130 page final report.

\$1.1M DARPA Ultra\*Log - Msg\*Log: Reliable Messaging for Logistics Planning - 2001-2003

Proposal Co-Author and Co-Principal Investigator. *Message\*Log, Reliable Messaging for Logistics Planning*, DARPA proposal in response to BAA 00-46 Ultra\*Log Program. DARPA Contract No. NBCHC010011, DARPA Order L221. Contract Duration: 12 February 2001 - 30 September 2003.

The UltraLog program is developing survivable agent middleware (reliable, secure, scalable), targeted at logistics and DoD Future Combat Systems program. My role: Developed policy management document for UL program and contributed to OBJS Survivable Message Transport, a core module of the DARPA Cougar agent system.

\$1.9M DARPA CoABS - Agility: Agent -Ility Architecture - 1998-2002

Proposal Author and Principal Investigator, *Agility: Agent -Ility Architecture*, DARPA proposal in response to BAA 98-01 Control of Agent Based Systems (CoABS) Program. Resulted in four year DARPA contract F30602-98-C-0159, DARPA Program Managers: Doug Dyer, Jim Hendler, Dylan Schmorrow. COTR Wayne Bosco (AFRL). Contract Duration: 18 June 1998 - 17 June 2002.

Presentations, poster sessions, and demos at DARPA PI Workshops in Pittsburgh, Las Vegas, Northampton, DARPA TIC Science Fair, Atlanta, Boston, Miami, Nashua. All monthly, quarterly, annual reports. CoABS Grid meeting, Philadelphia, PA, Mar 24, 1999.

C. Thompson, *Agility Final Report*: <http://www.objs.com/agility/final/CoABS-OBJ5-Agility-Final-Report.html>

C. Thompson, *Agility Overview*: <http://www.objs.com/agility/final/2001-10-25-CoABS-OBJ5-Agility-Project-Review.ppt>

Contributed architecture sections to: Brian Kettler, *GITI/ISX Grid Vision* document, April, 1999. [http://coabs.globalinfotek.com/public/CoABS\\_Program/Projects/GITI-ISX.htm](http://coabs.globalinfotek.com/public/CoABS_Program/Projects/GITI-ISX.htm)

C. Thompson, "Strawman Agent Reference Architecture," presented DARPA ISO Architecture Working Group, MITRE, Washington DC, Aug 13, 1998 and at DARPA ALP Workshop, Tampa, FL, Dec 8-10, 1998. <http://www.objs.com/agility/tech-reports/9808-agent-ref-arch-draft3.ppt>

The objective of the Agility project was to develop a light-weight agent grid architecture and implementation that is scalable and potentially pervasive by virtue of piggybacking on existing and emerging standards (e.g., email, web, search engines, Java, JINI, XML, distributed objects). Agility agent grid components were stand-alone useful but also composable with the CoABS grid (which Global Infotech developed.)

- **eGents Prototype** - The eGents system provides a scalable way to send (FIPA or KQML) agent communication language (ACL) messages encoded in XML by email, providing a light-weight agent platform that inherits many benefits from email: pervasiveness, disconnected messaging, security, firewall access, mobile users, logging, visualization. Using eGents, anyone with email can create an agent service that anyone else can use. See <http://www.objs.com/agility/final/eGents/EGENTS-PROJECT-SUMMARY.html>
- **WebTrader and DeepSearch Prototypes** - WebTrader is a trader which relies on web-based search engines to locate advertisements (want ads, classifieds) represented in XML that reside on pages anywhere on the web. The architecture is scalable by virtue of web search engines and federation is supported by means of advertisements for other webtraders and search engines. Using WebTrader, anyone on the Web can advertise a resource (e.g., agent, service, data source) that anyone else can discover. DeepSearch is an application of WebTrader which locates relevant local search engines on the web and recursively searches these. See <http://www.objs.com/agility/final/WebTrader/WEBTRADER-PROJECT-SUMMARY.html>
- **AgentGram Prototype** - Using menu-based natural language interfaces (MBNLI), end users select words and phrases from menus to construct sentences the system will understand - this takes the guess work out of NLI technology. AgentGram enables humans to query agents and other internet resources across the web using constrained natural language. AgentGram uses MBNLI and dynamically loaded grammars attached to agents to permit complex queries that may involve knowledge of several agents and provides a way for humans to task agents and for

agents to communicate with each other. See

<http://www.objs.com/agility/final/AgentGram/AGENTGRAM-PROJECT-SUMMARY.html>

In addition to prototypes, we participated in four technology integration experiments (TIEs): Non Combatant Evacuation Order (NEO), MIATA hurricane disaster recovery, CoAX Coalition, and Joint Battlespace Infosphere (JBI) Small Unit Operation (SUO).

#### \$2.8M DARPA IC&V - Scaling Object Service Architectures to the Internet - 1995-1999

Co-Author and Principal Investigator, Scaling Object Service Architectures to the Internet, DARPA proposal in response to BAA94-28 Intelligent Collaboration and Visualization Program. Resulted in three-year DARPA contract DAAL01-95-C-0112. Contract Duration: 29 September 1995 - 28 September 1998. DARPA Program Managers Dave Gunning, Barry Leiner, and Kevin Mills. ARL COTR: Morton Hirschberg. Responsible for Monthly Reports #1-42, Semiannual Reports #1-7, Annual Reports #1-3. DARPA/ISO I3 PI Meetings: Miami Beach, San Diego, Berkeley, others.

The purpose of this contract was to demonstrate how to compose object service architecture (OSA) componentware modules into systems that interoperate across the Internet. Identified the *Intermediary Architecture (IA)*, which is a way to add middleware services via a series of Web proxies, providing a way to *scale - OSAs - to the Internet*.

C. Thompson, G. Hansen, F. Manola, M. Palmer, P. Pazandak, V. Vasudevan. Final Report, September, 1998. <http://www.objs.com/OSA/Final-Report.html> Includes sections on Intermediary Architecture, Intermediary Architecture Interceptor, Web Object Model, Annotation Service, Personal Network Performance Monitor Service, NLI Query Interface, Trader Service, WebTrader, Augmenting OMG Traders to handle Service Composition, Some Web Object Model Construction Technologies, Towards a Richer Web Object Model, Towards a Web Object Model.

C. Thompson, S. Ford, G. Hansen, S. Joseph, A. Kurien, F. Manola, P. Pazandak, V. Vesudavan, D. Wells, N. Wells, Internet Tools Survey, October 1996. <http://www.objs.com/survey/survey.htm>. Includes sections on Visions: Application and Technology Drivers, Objects and the Internet: Componentware Glossary, Internet Engineering Task Force Overview, Object Management Group Overview, Object Models, Requirements for OO + Web Integration, Current Web Architecture, Web Programming Languages, Web + Object Integration, Web + DBMS Integration, Semantic File Systems, Wrappers, Quality of Service, Managing and Using Information: Hypermedia Systems and WWW Browsers, HTML Authoring Tools, Searching and Indexing, Groupware & Collaboration Support, Video Conferencing, Security: Authentication, Encryption, Virtual Private Networks, Virtual Office: Virtual Office White Paper, Enabling Technology for Virtual Office Applications, Electronic Support for Collaboration & Decision Making in OBJS, Initial Use of COTS Tools in the OBJS Virtual Office, Virtual Office Scenarios.

#### \$5.5M DARPA POB/I\*\*3 - Open Object-Oriented Database - 1990-1995

Project Manager and Co-Principal Investigator, *DARPA Open Object-Oriented Database (OODB) Phase I and II* contracts DAAB07-90-C-B290, 1990-1993, \$3.1M and DAAA15-94-C-0009, 1993-1995, \$2.4M.

Project developed the idea and a reference implementation of an object services architecture (OSA), an object bus plus object services, later evolved by OMG to CORBA and CORBAServices. Demonstrated a modular OODB-RDB hybrid with reasonable performance. My role: principal author

of both proposals, project lead, co-architect and co-inventor, organized workshops, led technology transfer effort, and influenced relevant standards, long and short range planning, administration.

Academic collaborations that resulted from Open OODB included: U. Wisconsin (Dave DeWitt, Mike Carey), Brown U. (Stan Zdonik), OGI (Dave Maier), MIT (Barbara Liskov), Berkeley (Randy Katz), U. Darmstadt (Alex Buchmann), U Mass (Jack Wileden), UT Arlington (Ramez El Masry), U Florida (Sharma Chakravarthy), SMU (Maggie Eich), Portland State (Goetz Graefe).

#### Phase II - 1993-1995

Proposal Abstract: C. Thompson. "Open OODB - Phase II: Validating the Object Services Architecture." Proposal Abstract in response to DARPA BAA 93-11, January 29, 1993. (\$3,882K, 36 month). 247 proposals received; full proposal requested.

Proposal: C. Thompson, J. Blakeley, and D. Wells. "Open OODB - Phase II: Validating the Object Services Architecture." Full proposal in response to DARPA BAA 93-11, March 15, 1993. Won Contract DAAA15-94-C-0009: 3 year, \$2. 4M + \$1. 9M options in FY94-FY97, no cost sharing. DARPA/SISTO Program Manager: Gio Wiederhold, Dave Gunning. DARPA Agent: Morton Hirschberg, Army Research Labs, Aberdeen Proving Ground. Responsible for Progress Reports and Reviews. Monthly Reports #1-24 plus semi-annual reviews and annual reports.

Software Releases: *Open OODB Toolkit Release 1.0*, DARPA Open OODB II Project, September 1995. Released documentation: Document Manifest, Executive Summary, Technical Overview, Requirements, Computational Model, System Architecture, Module Specs, C++ API Installation Manual, C++ User's Guide, OQL[C++] User's Guide, Common Lisp Installation Manual, Common Lisp User's Guide, Design Notes, Release Notes. C++ and Lisp versions of Open OODB were deployed at 25 government approved alpha sites and the system is currently licensable "as is" as a research product from (then TI, now) Raytheon.

#### Phase I - 1990-1993

Proposal: C. Thompson, D. Wells, S. Thatte. "Open Zeitgeist: A Modular Object-Oriented Database System," TI Proposal No 39-R89 BAFO submitted in response to DARPA/ISTO BAA 89-05. Contract DAAB-07-90-C-B290, awarded: \$3.1M over 3. 5 years. Contract duration: 31 August, 1990 - 17 December 1993. DARPA Program Manager: Lt. Erik Mettala, Deputy Directory, DARPA/SISTO, then Gio Wiederhold. COTR: Steve Turczyn, U. S. Army CECOM, Fort Monmouth, N. J, then Morton Hirschberg, ARL, Aberdeen Proving Ground, MD. Responsible for Monthly Reports No. 1-36, Quarterly Reviews No. 1-12, Annual Research Summaries, June, 1990-93. Also see Workshops below.

C. Thompson and D. Wells, "ARPA Open OODB Phase I Final Report," January 1994.

#### Software Releases:

Open OSA Toolkit Release 0.2, September, 1993. J. Blakeley, S. Ford, M. Mallison, E. Perez, J. Ramey, A. Srivastava, C. Thompson, D. Wells, DARPA Open OODB Project, 20 August 1993. Alpha Release of the C++ and Common Lisp Object Services Toolkit. Includes: Release Notes, Installation Guides, and User Guides. Software released to 30 government, academic, and industrial sites.

C. Thompson. "Open OODB Requirements," May, 1991. First comprehensive requirements document in the OODB area. Accepted as a base document by ANSI X3H6 CASE Integration Services. 43 pages.

C. Thompson. "Open OODB Glossary," May, 1991. First comprehensive glossary in the OODB area. Base document for ANSI X3/OODB Task Group "OODB Glossary." Also, used by James Martin and Grady Booch in their books on Object Technology and Object Analysis and Design, 42 pages.

C. Thompson. "Interface Specification: Change Management Module," Open OODB project, Texas Instruments, November 1991. 100-page document includes reference model and interface specification for a generic, object-oriented change management system (versions, configurations, constraints). Document was sent to ANSI X3H6 for review in 1992, to NIIIP's Version Management Team, and formed the basis for OMG's Object Services Architecture descriptor for the Change Management Service. See OMG document omg/95-08-29

Versant (OODB vendor) adopted TI Object Query Language specification in 1991.

Organizer and authored workshop report, DARPA Open OODB Workshop Series, 1991-1993.

"Report on DARPA Open OODB Workshop IV," Salt Lake City, March, 1993. Two-day workshop.

"Report on DARPA Open OODB Workshop III," U. Colorado at Boulder, March, 1992. Two-day workshop, 18 pages.

"Report on DARPA Open OODB Workshop II," Dallas, Texas, October, 1991. Three-day workshop, 55 pages.

with D. Wells. "Report on DARPA Open OODB Workshop I," Dallas, Texas, May, 1991. Three-day workshop, 60 pages.

TI-funded Zeitgeist OODB - prelude to Open OODB

Project lead and co-architect with David Wells, TI Zeitgeist Object-Oriented Database System, 1984-1990. Project was ranked 1 or 2 out of 30 projects in TI R&D Computer Science Center for several years running. Main internal application was the TI DROID VLSI CAD system.

#### Independent Research and Development (IR&D) Projects - 1984-1990

*NOTE:* These technical reports summarize annual research progress and plans. As an incentive for research that has potential military significance, companies are reimbursed for research dollars spent, based on scores and project size. Each report was reviewed and scored for technical significance and technology transfer impact by three or more DoD technical specialists. A score above 8 is excellent; my average score was 8.34/10. Each report required 100-150 hours to prepare. There were no reports after 1990 since, by then, all our research was externally funded.

\$1.9M - C. Thompson. "Object-Oriented Database System," 1990 IR&D Brochure, Information Technologies Lab, Texas Instruments. Score: 8.68. The 1990 report covered a 12MY research program. Prepared IR&D presentation and Poster Board for May 15-17 Triennial Review.

\$900K - C. Thompson. "CommonTools Hypermedia Environment," 1989 IR&D Brochure, Information Technologies Lab, Texas Instruments. Score: 8.46. The 1989 report covered 6.2 man-year research program.

\$? - C. Thompson. "CommonTools Hypermedia Environment," 1988 IR&D Brochure, Artificial Intelligence Lab, Texas Instruments. Score 8.72.

\$? - C. Thompson, D. Wells. "Distributed Object-Oriented Database System," 1987 IR&D Brochure, Texas Instruments, 1987. Score 7.73.



\$600K - C. Thompson. 1986 IR&D Brochure, Database Systems Branch, Artificial Intelligence Lab, Texas Instruments. Score unknown. The 1986 report covered our new OODB program with a 5 man-year effort.

\$2M - C. Thompson. 1985 IR&D Brochure, Knowledge-Based Systems Branch, Computer Science Lab, Texas Instruments, 1985. Score: 8.1. The report covered 18 man-year effort and won award for the best large project in the Computer Science Center.

\$? - C. Thompson. 1984 IR&D Brochure Knowledge-Based Systems Branch, Computer Science Lab, Texas Instruments, 1984. Score unknown.

*Contributions to selected other proposals and contracts*

D. Wells, S. Ford, C. Thompson, *Software Surveyor*, OBJS proposal in response to DARPA BAA00-20 DASADA: Dynamic Assembly For Systems Adaptability, Dependability, and Assurance. Resulted in two year 4MY contract, 2000-2003. Contract awarded. OBJS PI David Wells. DARPA PM John Salasin. Co-authored proposal but did not work on contract.  
<http://www.objs.com/DASADA/index.html>

C. Thompson. *Everything is Alive*, Proposal in response to DARPA BAA 99-07 Information Technology Expeditions, submitted January 1999, not selected but praised. Cheap tiny components lead to distributed computing *everywhere* and soon. See <http://www.objs.com/reports/9901-everything-is-alive.html> for a general interest section of the proposal later published as a tech note.

D. Wells, C. Thompson, *Evolution in Object Service Architectures*, OBJS proposal in response to DARPA BAA95-40 Evolutionary Design of Complex Software (EDCS). Resulted in two year \$800K contract awarded, October 1996-October 1998. OBJS PI David Wells. DARPA PM: Teresa Lunt, then Sami Saydjari. My role: co-authored the proposal.  
<http://www.objs.com/Survivability/index.html>.

DeGroot et. al., *Trauma Care Information Management System (TCIMS) Consortium*, TI proposal led to 2-year, \$15M Rockwell-led consortium. Proposed in response to DARPA Technology Reinvestment Program (TRP), 23 July 1993. TI share \$1.7M (\$570K DARPA, rest TI cost-share). DARPA Program Manager: John Silva, DARPA/SISTO. Partners: Rockwell (lead), UTA, SAIC, AT&T, DEC, USC/ISI, others. Description of Program: Develop reference model and reference implementation for generic Trauma Care Information Management System, including military and civilian, urban and rural system demonstration. TI hook: system architecture, DSSA, CASE IEF/BDF, connection to PCs. My role: co-architect briefly after contract awarded, then handed off to Paul Brown as I left TI to start OBJS.

Co-author, \$60M DARPA TRP National Industrial Information Infrastructure Protocols (NIIIP) Consortium proposal, 23 July 1993. Funded September 1994. TI share, \$1M total, 50% cost share. See Consulting section.

C. Thompson. "Database/Data Interchange" section in *Final Report of Rapid Prototyping of Application-Specific Signal Processors (RASSP) Phase I Study Contract*, October, 1992. Presentation to DARPA/ESTO, 11 September, 1992. Customer gave us a grade of "A"; received letter of commendation. Did not participate in \$100M Phase II proposal, TI did not win.

C. Thompson, M. Morrison, C. A. Thorne, R. Tighe. *TI TelAction Store Management System*, TI proposal for TelAction Corporation, Schaumburg, Illinois, 60173, December, 1987. TelAction was

developing an interactive home shopping cable channel. A home user watching cable uses a touch tone phone to navigate e-stores - field tested in Chicago - pre-web attempt at hypermedia for the masses. TI contract was for authoring electronic malls, design of the delivery environment database, and manufacture of the pole-mounted frame grabber. With Rusty Lewis, championed TelAction opportunity at TI; led team to develop a prototype electronic mall authoring system; lead on interacting with TI product group and in writing proposal. \$20K prototyping contract awarded. Follow-on contract not awarded since Telaction did not survive. Could have led to \$800M TI business by our estimates. A possible earlier WWW that did not make it.

Provided spatial database and menu-based natural language technology for TI DSEG DARPA/USAF *Robotic Air Vehicles* (1985).

Co-authored spatial database sections of winning \$20M TI DSEG DARPA/SPAWAR *Science of Smart Weapons*, Phase I proposal (1984).

Provided menu-based natural language technology for \$4M TI DSEG DARPA/USN *Force Requirements Expert System (FRESH)* and championed the effort to port TI NLMenu/FRESH to micro-Explorer and later to Sun (1983-1990).

J. Carnegie, L. McCalla, C. Thompson. *Integrated Design Automation System (IDAS)*, TI DSEG proposal for US Air Force, 1984,. Team: Texas Instruments, RCA, Silvar-Lisco, and Sperry. \$12M bid, RFP rescinded by USAF; follow-on effort was USAF Engineering Information System (EIS), a precursor to the industrial consortia CAD Framework Initiative. OMG was eventually the dominant successor.

\$48M *Ground/Air Interactive Terminal* contract (1983) - provided the technology (MBNLI interface generation capability and MBNLI demo) permitting AWACS-based end user to query status of air fields, fuel depots, and nudets (nuclear detonations) in a crisis - that enabled TI DSEG to win the G/AIT contract

## Consulting

### *Legal Consulting*

#### Reed-Smith - 2008-2009

Infringement and validity expert witness. Related to databases for decision support.

#### Sterne-Kessler - 2008-2009

Non-infringement and invalidity expert. Settled out of court. Related to ETL/workflow.

#### Latham and Watkins - 2007-2008

Non-infringement expert. Settled out of court. Related to negotiation software.

#### Kirkland-Ellis - 2007-2008

Consultant for defense. Related to Visto v. RIM.

#### Wong, Cabello, Lutsch, Rutherford & Brucculeri, L.L.P. - 2007

Consultant for defense - identified and reviewed prior art. Related to downloading movies.

Wilmer-Hale - 2006

Non-infringement expert witness for the defendant in Hyperion (Howrey) v. OutlookSoft (Wilmer-Hale) - jury trial in Marshall, TX. Defendant won on non-infringement and invalidity.

King and Spalding LLP - 2005

Consultant on patent infringement case involving Software AG and BRA Systems. Settled out of court.

Jones Day - 2003

Consultant on patent infringement case representing the defendant in Intergraph v. Texas Instruments. Settled out of court.

Howrey LLP - 2002-2003

Deposed as fact witness on patent infringement case representing the defendant in Business Objects v. MicroStrategies (Howrey) - settled out of court within a week of my deposition.

*Technical Consulting*

My consulting for OBJS was mainly aimed at positioning OBJS in a software architect's role in important research programs or at expanding OBJS business or technical horizons, positioning us to win future larger contracts.

IDA & RAND Subcontracts - 1998-1999

Wrote "White Paper: DARPA Participation in Industry Standards Development Organizations" for DARPA ISO Assistant Director Dave Signori, which led to a series of four \$20K consulting contracts on open issues in the DARPA Advanced Information Technology Services (AITS) architecture - system-wide properties, common schema, grids, and interoperability.

DARPA CoABS-ALP Integration Report - 1999

Wrote white paper "Common CoABS and ALP Architecture Issues" for DARPA program managers Jim Hendler (Control of Agent Based Systems - CoABS) and Todd Carrico (Advanced Logistics Program - ALP). Led to \$119K add-on to DARPA Agility contract. Resulted in a Final Report by Frank Manola on how the ALP agent and CoABS grid architectures could be integrated. OBJS subsequently won a DARPA UltraLog contract - UltraLog is a follow-on to ALP.

MCC Very Large System Engineering (VLSE) - 1998

Invited by TW Cook, Marek Rusinkiewicz (MCC) and Doug Dyer (DARPA program manager) to join a small team to formulate a potential new program for DARPA called VLSE aimed at understanding, controlling, evolving, and making survivable very large software systems of systems. Coined the VLSE name (such as it is). Contributed to paper and presentation and participated in VLSE Workshop in Arlington, VA, on 9 Feb 1998 by invitation from Al Wargo, COO of MCC. Word came: "The whole thing is on hold while DARPA reorganizes" - then VLSE was absorbed into other DARPA programs, most directly DASADA. OBJS subsequently won a DARPA DASADA contract.

MCC Object Infrastructure Project - 1996-1998

Invited by TW Cook (MCC project manager) to consult for and review the MCC Object Infrastructure Project, whose goal was to understand a framework for insertion of system-wide properties (-ilities, QoS) into large-scale distributed software architectures. Two main outcomes: the paper for OMG on a next generation object management architecture and the *Workshop on Compositional Software Architectures*.

#### DARPA Advanced Information Technology Services (AITS) Architecture - 1997-1998

Invited by Dave Signori (Deputy Director, DARPA/ISO) to serve on a Review Panel for the DARPA ISO Advanced Information Technology Services (AITS) architecture. AITS was a spanning architecture meant to cover JTF, JFACC, ALP, GENOA, BADD, and other DARPA/ISO application architectures. This involved meetings, contributions, and recommendations.

#### DARPA Dynamic Database Study II - Summer, 1997

Invited by Tom Burns (DARPA DDB program manager) to sit on the Dynamic Database Panel II which provided inputs to shape the subsequent DARPA DDB BAA. My contributions covered -ilities, federation, object service architectures, and GIS standards.

#### DARPA Intelligent Integration of Information (I3) - 1995

Invited by Dave Gunning (DARPA I3 program manager) to help organize and co-author the *DARPA Reference Architecture for Intelligent Information Systems*. The I3 program aimed to provide a system-level architecture to provide easy access to information - in the form needed by end-users and high-level applications - by extracting and mediating information from the plethora of available data sources.

#### DARPA ISO Infrastructure Panel - 1995

Invited by John Schill (DARPA ISO program manager) to sit on the DARPA ISO Infrastructure Panel. Contributed presentation on object services architectures and co-authored the panel's report.

#### National Industrial Information Infrastructure Protocols (NIIIP) Consortium - 1993-1997

Invited by Richard Bolton (NIIIP Director) to consult on software architecture for the *National Industrial Information Infrastructure Protocols (NIIIP) Consortium*. At \$60M, IBM-led NIIIP was the largest, most visible DARPA National Information Infrastructure (NII) Technology Reinvestment Program (TRP). NIIIP focused on developing technology to enable virtual enterprises. The DARPA Defense Science Office (DSO) program managers overseeing NIIIP have been Gio Wiederhold, Dave Gunning, Pradeep Khosla, and Kevin Lyons with John Barnes (MANTECH) as DARPA agent. Partners: IBM (lead), TI, Taligent, DEC, STEP Tools, EITech, CAD Framework Initiative, NIST, U Florida, General Dynamics, John Deere, others. My role: system architecture consultant. Co-authored the NIIIP proposal, Articles of Collaboration, and NIIIP Reference Architecture.

## ***SERVICE***

### **Standards**

My interest in standards has primarily been in *anticipatory* standards, that is, in shaping a new area so that R&D results can flow directly to industry. This requires having "the big picture" of a subject domain and a good idea of scope and architecture. My approach is to de-construct, then re-construct to determine *separation of concerns*. Why the interest in standards? High impact - a small research effort with significant expertise can influence the direction of a new area of industry and leave its imprint. In addition, this is a route to taking research results right to industry's top architects.

#### ***IEEE RFID Strategic Plan Committee, May 2008 - present***

Member, IEEE RFID Strategic Plan Committee. Two telecons and one meeting in Denver in July, 2008 to organize a 5 year plan for RFID within IEEE.

#### ***EPCglobal - 2007***

My Ph.D. student Joe Hoag developed the Java class library for the brand new EPCglobal Low Level Reader Protocol (LLRP).

#### ***Object Management Group (OMG) - 1990-2002***

OMG (<http://www.omg.org>) is the software industry's largest open standards development organization with over 800 member organizations. Its mission is to develop a modular suite of specification patterns and services for distributed object middleware in order to promote enterprise integration, application portability, and system interoperability. This standardization process should (over time) make applications easier to build, more reliable, and more understandable.

#### **OMG - General Contributions**

I have been an active contributor to OMG since 1990, nearly the beginning, co-authoring and editing a number of key OMG documents that helped shaped the OMG architectural landscape. My role: TI representative 1990-1995, OBJS representative 1995-2002. Organizer and Co-chair, OMG Agent Working Group, 1998-2002. Organizer and Co-chair, OMG Internet Special Interest Group, 1995-1998. Member, OMG Object Services Task Force (OSTF), OMG Common Facilities Task Force (CFTF), OMG Object Model Task Force (OMTF), OMG Standards Liaison Subcommittee. [Main contributions are listed under Publications/Reference Architectures; additional contributions are listed below.]

#### **OMG - Internet Special Interest Group (ISIG) - 1995-1998**

Organized the OMG ISIG which aimed to help unify Internet and Web technology with OMG object technology. Co-chaired with Shel Sutton (MITRE). Arranging for speakers and agendas, led meetings, completed the minutes, and maintained the homepage - see <http://www.objs.com/isig/home.htm>. ISIG accomplishments:

- RFI and RFPs - As a result of OMG Internet SIG's RFI recommendations, the OMG Common Facilities and ORBOS Task Forces redirected some of their efforts to Internet-related RFPs including Common Internet Protocols, Java-to-IDL (Java Reverse Mapping), Firewalls, Component Model, Scripting Language.
- Working groups - ISIG was home to several active working groups: Compositional Software Architectures, Agents (prior to Agent SIG), Computer Supported Cooperative Work, Web-OMA Integration Architectures, Object Transfer and Manipulation Facility.

#### OMG - Agent Special Interest Group - 1998-2001

Organized the OMG Agent Working Group which aims to identify how to unify agent and object middleware technologies. Co-chaired with Jim Odell, Francis McCabe, and Steve McConnell and maintained OMG Agent Working Group Homepage - see <http://www.objs.com/agent/index.html>.

#### *World Wide Web Consortium (W3C) - 1998-2000*

OBJS was a member of W3C (<http://www.w3.org/>). Took over from Frank Manola as OBJS' W3C voting representative in 1999.

#### *Foundation for Intelligent Physical Agents (FIPA) - 1999-2001*

OBJS responded to the FIPA (<http://www.fipa.org/>) Call for Proposals in 1999 with: a description of *ACL encoded in XML* (V. Vasudevan) which also contained the idea of email transport for agents (both ideas adopted) and *Strawman Agent Reference Architecture* (C. Thompson), which helped FIPA restructure to a more abstract architecture.

#### *Object Data Management Group (ODMG) - 1992-1995*

Reviewer member and critic, attended two meetings, kept up by email. Open OODB kept us participating.

#### *ANSI X3H7 Technical Committee on Object Information Management - 1992*

The initial mission of X3H7 (from 1992-1995) was to harmonize the many object models to make information sharing easier. Later, the mission shifted to developing a taxonomy of object models, which was originally to be the first step. Eventually, X3H7 merged with X3T3 Open Distributed Processing (ODP). My role: X3H7 co-organizer, voting member, liaison to ANSI X3H4 Information Resource Dictionary Services (IRDS), and author of initial X3H7 documents in 1992 including a press release, mission statement, base document outline, and scenarios.

*Matrix of Object Model Features by Object Model Systems* (initial editor). Also authored "OODBTG Description" in matrix. This work eventually resulted in Frank Manola (ed), *NCITS H7 (formerly X3H7) Object Model Features Matrix*, June 1997.

#### *Workshop on Application Integration Architectures*

Organizer, co-chair with Bob Hodges (TI), and author of the workshop report. *Workshop on Application Integration Architectures*, Dallas, Texas, February 8-12, 1992. Published as NIST Technical Report and also OMG Document 1994/94-1-2.ps. Workshop convened key contributors to

key industry standards groups and consortia, including DARPA, Object Management Group, Open System Foundation, X/Open, Portable Common Tools Environment, CAD Framework Initiative, PDES/STEP, EIA/CDIF, DARPA STARS, ECMA NIST Reference Model, ODMG, X3 OODB Task Group, ANSI X3T3 ODP, ANSI X3H2 SQL, ANSI X3H4 IRDS, ANSI X3H6 CASE Integration Models, and ANSI X3H7 Object Information Management. The objective of the workshop was to construct a road map for how the participating organizations can cooperate to realize the shared vision of a common industry-wide integration architecture to guarantee standards produced by these organizations would interoperate.

***ANSI X3 Database Systems Study Group (DBSSG) Object-Oriented Database Task Group (OODBTG) - 1989-1991***

Vice Chair, ANSI X3 SPARC/DBSSG OODB Task Group, 1989-1991. Bill Kent (HP) was chair.

The mission of OODB Task Group was to characterize what OODBs are so that a new industry could form. Based on our Zeitgeist OODB and DARPA Open OODB experience, we recommended an open modular architecture. Unexpectedly, this architecture ended up influencing the OMG Object Management Architecture more than it did the Object Data Management Group (ODMG), which developed monolithic OODB standards.

## **Professional Activities**

### ***Honors***

Inducted into *Arkansas Academy of Computing* on April 11, 2008

*IEEE Fellow* "for contributions to artificial intelligence, database management, and middleware," elected 2005. Elected Senior Member of IEEE, 1987.

*Charles Morgan /Acxiom Graduate Research Chair in Database*, University of Arkansas, 2005-present. \$3M endowed chair. *Acxiom Database Chair in Engineering*, University of Arkansas, 2003-2005.

*Faculty-Student Collaboration* award, for presentation related to *Everything is Alive* project at the U Arkansas Freshman Academic Convocation, August 2007.

*Outstanding Service* award, May 2007. *Outstanding Researcher* award, May 2005. CSCE Department, University of Arkansas.

*Faculty-Student Collaboration* award, for presentation related to *Amiiga Business Plan* at the U Arkansas Freshman Academic Convocation, August 2006. This project also placed 6<sup>th</sup> in the U San Francisco Business Plan Competition and placed 2<sup>nd</sup> in the *Arkansas Governor's Cup Business Plan Competition* winning the *Technology Award*.

Inaugural member of the University of Arkansas "Honors College Faculty," 12 September 2006.

At the University of Arkansas State and National Awards Reception, received a plaque of recognition etched *with gratitude for exceptional service* from the Office of Post-Graduate Fellowships 2005, College of Engineering and a Mentor Plaque for my work mentoring 11 Honors Undergraduate Research Grants.

I received a letter from Dr. Johnette Brazzell, Vice-Chancellor for Student Affairs, dated May 2004 and again on May 2005 and again July 2007 that stated "When the Registrar's Office sent

the Registration for Graduation packets last January, we included a card for students to mention the faculty member who most influenced their college career. You were one of the individuals noted by a student, or students, as making a difference in their university experience."

*Letter of Commendation* from Ed Stull, Chair of ANSI X3/SPARC/DBSSG, 1992. For substantial contributions to X3/SPARC/DBSSG OODB Task Group which resulted in the OODB Task Group Final Report in September 1991. Stull stated that our work "has been recognized and accepted world wide" and that it lays "the foundation for the technology associated with information management of objects," which will affect "key aspects of the (overall) X3 program of work."

*Patent Award* for \$10,000. For "Menu-Based Natural Language" patent, one of the five top Texas Instruments patents awarded in 1989.

Elected *Senior Member of Technical Staff*, Corporate Research, Texas Instruments, 1985. SMTS limit is 7% of TI Member of Technical Staff population.

Summer Graduate Fellowship, The Graduate School, The University of Texas, Austin, Summer, 1977.

Cash Award, Annual CS Research Paper Competition, Department of Computer Science, UT Austin, October, 1972.

### ***My Student's Honors***

Craig Thompson's *Modeling Healthcare Logistics in a Virtual World* was presented to industrial advisors at three industrial advisory board meetings of the RFID Research Center and two industrial board meetings for the Center for Innovation in Healthcare Logistics in 2008.

Craig Thompson's *Everything is Alive* pervasive computing project was one of four projects selected for video presentation at the 2007 Freshman Academic Convocation on August 19, 2007. His team won a *Faculty-Student Collaboration Award* (\$1000).

Joe Hoag, Craig Thompson, "TagCentric RFID Middleware," Open source software released on SourceForge, March 2007. 800+ downloads, <http://tag-centric.sourceforge.net/> & <http://sourceforge.net/projects/tag-centric/> Led to several interactions and collaborations with industry: SensorConnect, Pramari, Impinj, Oat.

Carol Reeves and I served as faculty advisors for the Amiiga LLC team which included three WCOB Management graduate students and CSCE undergraduate Kyle Neumeier. Their project was based on my research on menu-based natural language interfaces. The team placed 6<sup>th</sup> in a field of 100 beating MIT and other nationally known schools in an international business plan competition at San Francisco State in Spring 2006. The team place 2<sup>nd</sup> in the Arkansas Governor's Cup in Spring 2006, winning the Technology Award. The faculty and students received a collaboration award and presented at the Freshman Convocation, August 2006.

My Ph.D. student Joe Hoag and I co-authored an *IEEE Internet Computing* paper. My M.S. student Rishikesh Jena and I co-authored an *IEEE Internet Computing* paper. With students, I co-authored five papers at *IEEE International Conference on Integration of Knowledge Intensive Multi-Agent Systems*. Several of my students have presented our joint work at the *Acxiom Laboratory for Applied Research Conference*, and one at the *First International Workshop on Smart Grid Technologies*.

My honors thesis student Oladayo Olagunju was accepted with a full ride at Stanford Business School. My honors grant student, Quang Duong, received the *Fulbright Distinguished Freshman*



*Computer Science Student Award.* As a sophomore, Quang was accepted with a full ride at Harvard for his Junior and Senior year. My honors grant students James Matt Doyle and Kevin Smith were accepted to Carnegie Mellon for graduate school. After completing a capstone project and successfully demoing to champions at Wal-Mart, my student Divya Balaji was accepted at Duke for graduate school.

My undergraduate student Minh Vu, working on my Everything is Alive agent system project, received one of around fifty Honorable Mention awards in Microsoft Research's national Computing Research Association (CRA) contest for outstanding undergraduate in 2005.  
<http://www.cra.org/Activities/awards/undergrad/2005.html>

My undergraduate students Midori Kubozono, Jared Allen, and Kyle Neumeier published papers in the University of Arkansas *Inquiry Undergraduate Research Journal* in 2004, 2005, and 2006.

In Spring 2005, my student Kevin Robinson drafted the initial Testing Procedure for the new RFID Center which defines how that center tests RFID readers and tag placement.

Based on a special project class on financial middleware, my student Joseph Ehrhardt was promoted from bank teller at Arkansas National Bank to be its first Information Officer and is now hiring other CSCE B.S. students.

In 2004 I advised Libby Stotler, a junior in the CSCE Department, when she completed an SBIR submission to the Air Force (subsequently not funded), started an S-corporation *InCom Solutions*, and pursued a patent. Three of my Senior Design/Capstone teams have started small businesses.

In Fall 2003, my undergraduate student Midori Kubozono developed The Last Frost program to predict when a company should deliver Spring bedding plants based on last frost of the season probabilities in the U.S. The program was fanned out to all U.S. Wal-Mart stores.

### ***Service***

Member, Editorial Board, *IEEE Internet Computing*, July 2003 - present.

<http://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=4236> *IEEE Internet Computing* ranks high annually in "impact factor." Duties:

- Architectural Perspectives Column - three columns annually May 2003 - September 2008 - see papers in II.C.2
- Review editor for around ~5 papers annually - identify reviewers and make final recommendation.
- Guest editor for three special issues
- Participate in Board of Editors Annual Meetings: New York City, 2004; Dublin, 2005; Boston, 2006.

Member, Program Committee, *Smart Grid Technologies Workshop, International Conference on Autonomous Agents and Multi-Agent Systems (AAMAS)*

- Utrecht University, Netherlands, July 25-29, 2005.
- Estoril, Portugal, May 12, 2008.

### ***Memberships***

Member: IEEE Computer Society, ~28 years.

- Member, IEEE TAB Technical Committee on RFID, 2008
- Member, IEEE TAB Technical Committee on Data Engineering.
- Chair, IEEE Computer Society, Dallas Chapter, 1986-87.

Member, Association for Computing Machinery (ACM), ~30 years. Member: ACM SIGART, SIGMOD, SIGIR.

Lifetime Member, Stanford Alumni Association.

Past member: American Association for Artificial Intelligence, Association for Computational Linguistics

### ***Reviewer***

Reviewer and Session Chair, IEEE Region 5, RFID session, Fayetteville, AR, April 20-22, 2007

Reviewed Robert Filman et. al., *Aspect-Oriented Software Development*, Addison Wesley Professional, Prentice Hall, 2004

Have reviewed for - *IEEE Internet Computing*, *IEEE Computer*, *Communications of the ACM*, *ACM Transactions on Database Systems*, *ACM Transactions on Office Information Systems*, *IEEE Data and Knowledge Engineering*, *IEEE Expert*, *IEEE Design and Test*, *VLDB Journal*, National Science Foundation, Texas Higher Education Coordination Board, Prentice-Hall and others. On SIGMOD Conference program committee 1989, 1991, 1996.

### ***University of Arkansas Service - 2003-present***

Prepared ABET Self Study Accreditation Report for Computer Science Program in the CSCE Dept. University of Arkansas, Fayetteville, AR, 2006 - accredited and 2008 - accredited.

Research Member, Center for Innovation in Healthcare Logistics (CIHL) - 2007-present.

Member, Steering Committee, RFID Research Center, Feb 2005 - present.

<http://itri.uark.edu/view.asp?article=242>

Member, Advisory Panel, Northwest Arkansas Museum Foundation, Ron Goforth - Director, 2006.

Member, Steering Committee, Arkansas Research and Education Optical Network, (AREON), August 2006-present.

Member, Steering Committee, Enterprise Computing Committee, Walton College of Business, August 2003-present.

Associate Director, Steering Committee, Acxiom Laboratory for Applied Research (ALAR), Designated an ALAR Research Investigator, 2004-present. Associate Director, 2005-2006.  
<http://research.acxiom.com/>

Member of the Board, Information Technology Research Center (ITRC) - 2004-present.  
<http://itrc.uark.edu/>

Member, Acxiom University Relations Meeting, 2003-present.

Committee Work, University of Arkansas

- Member, Research Council, College of Engineering, 2005-present
- Member, Undergraduate Curriculum Committee and Accreditation Committee, CSCE Dept., 2003-2006

- Member, Head Search Committee, Industrial Engineering Dept., Jul-Dec 2007
- Chair, Interim Head Search Committee, CSCE Dept., Dec 2004.
- Member, Homeland Security Committee, College of Engineering, 2003-2004

***Industry-University Relations - 1983-1995***

Reviewer for NSF Expeditions in Computing (preproposals), November 2008

Reviewer for NSF CyberTrust ISG, May, 2007

Reviewer for research proposals, State of Texas Higher Education Coordination Board, Austin, August 1995.

Member, Steering Committee, Computer Science Department Industrial Advisory Council

Member, Industrial Advisory Board, University of Texas, Arlington, 1994.

Member, Industrial Advisory Board, Portland State, 1994.

TI Industrial Liaison for:

- Jeff Ullman, Hector Garcia-Molina, Marty Tennenbaum, Gio Wiederhold, "Integrated Databases for Design and Manufacturing" project, Stanford Center for Integrated Systems, 1991-1995.
- EE/CS Programs, University of California at Berkeley, 1983-1990.
- CS Department Industrial Partner's Program, Brown University, c 1990.

Semiconductor Research Corporation, liaison with Carnegie Mellon University, 1986-88.

Member, Engineering Council, Central Research Development and Engineering Division, Texas Instruments, 1986-1987, 1990. Selected Senior Members of Technical Staff and university grants.

***TI University Grants I arranged and monitored - 1986-1995***

Jack Wileden, Open OODB Name Manager, U. Massachusetts, Amherst

Ramez El Masry, UT Arlington

Alex Buchman, Event-Condition-Action Rules, U Darmstadt, Germany

Stan Zdonik, OBServer/Encore OODB Project and OODB Queries, Brown University

Don Batory, Genesis OODB Toolkit Project, University of Texas at Austin

Sharma Chakravarthy, University of Florida

Dave DeWitt and Mike Carey, Exodus OODB Toolkit Project, University of Wisconsin

Maggie Eich, Transactions, SMU, Dallas

Gordon Everest, Magda Hanna, X3/OOBTG Survey, University of Michigan

Goetz Graefe, Parallel and Distributed Query Optimization, Portland State & Volcano Optimizer Generator, University of Colorado, Boulder

Randy Katz, Version Management consultant, University of California, Berkeley

Mark Linton, Interviews User Interface Toolkit Project, Stanford University

David Maier, consultant, Oregon Graduate Center

Curriculum Vita - Craig Thompson

Tom Malone, Object Lens, MIT Sloane School

*TI Distinguished Visitors that I invited and hosted*

Bjorne Stroustrup, AT&T Bell Labs

Jeff Ullman, Stanford

Gio Wiederhold, DARPA/Stanford

Mike Stonebraker, Berkeley

Carl Hewitt, MIT

Richard Zippel, MIT

Don Batory, UT Austin

Won Kim, MCC

## ***STRANGE BUT TRUE***

My great uncle-in-law's great grandfather Don Juan Bandini led a rebellion and conquered Los Angeles in 1837. He owned Casa De Bandini, now a restaurant in Old Town, San Diego.

My grandmother Kathryn Stanley was the highest paid office worker in LA in 1900.

My mother was a WAVE in San Diego during WW II, encrypting and decrypting messages for the US Navy.

My father saw the U.S. flag raised on Iwo Jima, was the last man off the aircraft carrier Bismarck Sea when it was hit by kamikazes and sunk in 1945; was in the first class of oceanography Ph.D.s to graduate from Texas A&M in 1950; and is a Professor Emeritus at the US Naval Postgraduate School in Monterey.

In around 1961, I met Lt. Cmdr. Don Walsh, Navy, one of the two men who, in January 1960, went in the Bathyscaphe to the bottom of the Marianas Trench, at 35,800 feet, the deepest spot in the oceans, off Japan, a feat never duplicated.

I grew up in Monterey, lived in London for a year when I was 10 and bicycled in England (mostly alone) and traveled in Italy (with my younger brother) for summers when I was 16, 18, and 20.

Jan and I met by the pool in Austin in February 1974 - how time flies when you are having fun! We went on a cruise to Alaska this summer (2005) to celebrate 30 great years of marriage. Glaciers are cool.

It has also been interesting to meet historic people over my career: US Navy Lieutenant Don Walsh who with Swiss engineer Jacques Piccard set the record in 1960 for the deepest descent below the ocean's surface in the bathyscaph - 35,800 ft in the Marianas Trench; Rear Admiral Grace Murray Hopper who co-invented COBOL in 1959-1961; Jack Kilby who invented the integrated circuit in 1958; George Heilmeyer who invented liquid crystal displays in the mid-1960s; Ted Nelson who coined the word hypermedia around 1965; Douglas Englebart who invented the mouse in 1968; Ray Tomlinson who invented email in 1971; Dan Bricklin who co-invented spreadsheets in 1979; my grad school office mate Gary Hendrix who founded Symantec in 1982; Bjarne Stroustrup who designed and implemented C++ around 1985; and Tom Berners-Lee who invented the World Wide Web in 1989. Other great computer scientists I have met or worked with and admired include: Don Knuth, Michael Stonebraker, Randy Katz, Gio Wiederhold, Jeff Ullman, Lotfi Zedah, Peter Denning, Richard Soley, and Harry Tennant.

My daughter Jennifer, 31, and her husband Mike graduated from Texas A&M in Computer Science and Engineering in 1999 and own a home in Fort Worth. They work for Motorola, and Jennifer manages a world-wide distributed team. For some years I had one grand dog, Shelby, but Shelby now has a younger human brother, Luke, born in April 2006. Luke is a constant reason to smile and to go to Fort Worth. J&M traded their starter home in for a relative mansion in 2008.

My daughter Kathryn, 26, graduated with a biophysics and mathematics double major from Centenary (oldest university west of the Mississippi), spent one summer at St. Johns College, Oxford, the next summer interning at UT Southwestern Medical Center in Dallas, and the next summer hiking 190 miles on the Coast-to-Coast trail across northern England. She co-authored an on-line book before leaving Centenary and is now in the Ph.D. program at Scripps Research Institute in La Jolla, CA, where she was one of only two students in her class to receive an NSF Graduate Fellowship. She co-authored a paper for *Science* in mid-2007. She married Brent Applegate, an

Curriculum Vita - Craig Thompson

industrial engineer in September 2006. They visited Africa on a mission trip in August 2007. She presented a paper at a *CS Lewis Conference* in Oxford in July 2008. After years at HP, Brent returned to the UCSD MBA program focused on entrepreneurial biotech studies and spend the summer 2008 interning. He will graduate in June 2009.

**EXHIBIT II: LIST OF MATERIALS REVIEWED**

1. **Infor Global Solutions (Michigan), Inc' Fourth Amended Invalidity Contentions with Charts**
2. **An Intelligent Business Forecasting System by H.C. Harrison and Gong Qizhong**
3. **Expert System for Automatic Authorization of Deficits by E. Zalma Casanova, J. Lopez Coronado, J.M. Munoz Platon, and L. Pacheco**
4. **Expert Systems and Sales Strategies by Robert W. Stone and David J. Good**
5. **US Patent 5,347,632 – Filepp et al**
6. **GoldMine Software Corporation Factsback Bulletin #371**
7. **US Patent 4,947,028 – Gorog**
8. **US Patent 5,283,856 – Gross et al**
9. **Empowering the Global Sales Force by John T. Hiatt**
10. **US Patent 5,450,314 – Kagami et al**
11. **US Patent 4,567,359 – Lockwood**
12. **US Patent 5,117,354 – Long et al**
13. **US Patent 5,216,592 – Mann et al**
14. **Mott's business-management expert planning system by P. Vernon**
15. **US Patent 4,853,852 – Rosen**
16. **An Approach to Reducing Delays in Recognizing Distributed Event Occurrences by Madalene Spezialetti**
17. **US Patent 4,931,932 – Dalnekoff et al**
18. **US Patent 5,168,445 – Kawashima et al**
19. **US Patent 5,191,522 – Bosco et al**
20. **US Patent 5,201,010 – Deaton et al**
21. **US Patent 5,283,865 – Johnson**
22. **US Patent 5,309,355 – Lockwood**
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